Report

Tittabawassee River Sediment Dioxin/Furan Concentration Variability

Prepared for

Dow Chemical Company

Midland, MI

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CH2MHILL

Contents

Acronyms and Abbreviations

CH2M HILL	CH2M HILL, Inc.
Dow	The Dow Chemical Company
LTI	LimnoTech, Inc.
MOCA	Midland Offsite Corrective Action
PPE	Personal Protective Equipment
ppt	part(s) per trillion
QAPP	Quality Assurance Project Plan
QC	quality control
SAP	Sampling and Analysis Plan
TEQ	total toxic equivalent
WWTP	Wastewater Treatment Plant

Tittabawassee River Sediment Dioxin/Furan Concentration Variability

1.0 Introduction

This document presents the results of two sediment sampling events conducted in support of the Dow Midland Offsite Corrective Actions (MOCA) program; one in the fall of 2003; and one in the summer of 2004. Both sampling events were part of an ongoing effort to characterize Tittabawassee River sediments and evaluate the variability of dioxin/furan concentrations within those sediments.

This report has been developed to document the field activities and report the data collected for these activities. It presents analytical results in such a manner as to provide a preliminary assessment of sediment conditions. The contents of this report include a discussion of:

- Field activities conducted during the two sampling events (Section 2);
- Laboratory analysis of sediment samples (Section 3);
- Summary of the analytical validation (Section 4);
- A discussion of the analytical results (Section 5);
- Detailed tabular information on the sample stations and cores collected (Appendix A);
- Detailed information on the analytical validation (Appendix B); and,
- All dioxin and furan congener-specific results (Appendix C).

2.0 Summary of Field Activities

2.1 Fall 2003 Tittabawassee Sediment Sampling

Sampling Design

In the fall of 2003, an investigation was conducted on the sediments in the Tittabawassee River under the *Preliminary Flow/Solids Monitoring and Sediment Thickness Characterization* (LTI, 2003). The objectives of this study were to improve the understanding of solids deposition and transport through the river system and provide preliminary data supporting an assessment of the stability of river and floodplain sediments. This study included the collection of 23 sediment cores during November and December 2003. The sediment cores were collected from a subset of probe locations that were measured during the Tittabawassee River probing study. The 23 sediment cores were collected at approximately 1-mile intervals, with an even distribution of center, left, and right channel samples to be

representative of the length of the river downstream of Dow, and the entire width of the river channel.

Summary of Field Activities

Twenty-three sediment cores were collected in November and December 2003. All cores were maintained and frozen in a vertical position. The sediment core stations were assigned a Station ID during the sampling activities. These Station IDs were then aliased Station IDs (and later Sample IDs) following Project protocol that was formalized after the sampling event. During sediment core collection, the depth to water, and the amount sediment recovered were recorded. A summary of these results is presented in Appendix A, Table A-1.

In the spring of 2004, the top 0.3 feet of each core was sectioned from each core using a hacksaw to cut through the frozen core liner. The samples were then placed in appropriate sample containers supplied by a laboratory, and shipped for analysis (refer to Section 3). The Station IDs, location coordinates, Sample IDs, sample depth intervals, and associated analytical batches are summarized in Table A-2.

A total of 23 sediment field samples were collected and sent for analysis during the Sediment Variability sampling. The only quality control (QC) samples collected during this sampling were field duplicates. Since each sediment sample was collected in a separate lexan tube, there was no need for additional QC sample types. Table A-3 of Appendix A summarizes the QC sample type, event frequency, and Quality Assurance Project Plan (QAPP) specified frequency for QC sample collection.

2.2 Summer 2004 Tittabawassee Sediment Sampling Event

Sampling Design

Two surface sediment samples collected during the fall 2003 event exhibited significantly higher dioxin/furan total toxic equivalent (TEQ) concentrations than the other samples (refer to Section 5 for discussion of the results). These two sample locations (THT-02245 and SHL-02235) became the focal point for design of the summer 2004 sediment sampling event.

The objective of the summer 2004 sampling was to collect sufficient data to evaluate sediment variability in the areas of elevated dioxins/furans measured in the Tittabawassee River sediment collected in 2003. To meet this objective, a stratified random sampling design was used to evaluate the variability of dioxin/furan TEQ concentrations in the immediate vicinity of the elevated dioxin/furan TEQ concentrations identified from the fall 2003 sampling. The stratified component provides information on the dispersion of contaminants, while the random component provides a more robust data set for spatial analysis.

To establish sampling locations according to this design, a center-point was first identified at the location of the original elevated dioxin/furan concentration. Then beginning at the center point, strata were established based on the following criteria:

- Transects were run through the center point both parallel and perpendicular to the river flow direction;

- Longitudinal strata boundaries were established at 22.5 degrees off both directions of each transect;
- Latitudinal strata boundaries were established between the longitudinal boundaries at logarithmically increasing distances from the center point along the transects; in this case, approximately 3, 30, 100, 330, and 980 feet from the center point.

Finally, random sample locations were then generated in each of the five strata, and in up to four directions (depending if the location fell within the river channel). A schematic diagram of the stratified random sampling design is provided in Figure 1. Analysis of samples took place in phases, with the results from the closest proximal samples evaluated prior to determining which (if any) additional samples would be analyzed.

Additionally during the summer 2004 sampling event, three sediment cores were collected in the vicinity of the Saginaw Township Waste Water Treatment Plant (WWTP) outfall to evaluate its potential impact on dioxin/furan concentration in sediments. One core was collected upstream, one adjacent, and one downstream of the outfall. The actual locations of the cores were determined by the field lead based on observed sediment patterns in the area. For more information, refer to the Sampling and Analysis Plan (SAP) for Sediment Variability Sampling (CH2M HILL, 2004). This document is included with this report as Attachment 1.

Summary of Field Activities

Sampling to evaluate sediment variability in areas of elevated dioxins/furans was performed on July 1 and 2, and July 7 through 9, 2004. This effort included the collection of 35 sediment cores of varying length, but no greater than 5 feet, in accordance with the *Core Sediment Sampling Field SOP* (CH2M HILL, 2004). During sediment core collection, the depth to water, depth of sediment penetrated, and sediment recovered measurements were recorded. A summary of these results is presented in Appendix A, Table A-4.

At the end of each day, all sediment cores were maintained in vertical orientation and transferred to the sampling warehouse in Midland for storage in a sample freezer, also in the vertical orientation. After all of the sediment cores were collected and frozen, the samples planned for initial analysis were processed. This was accomplished using a hacksaw to cut the frozen core liners to separate the top 0.3-foot interval. In total, 13 cores were processed in this manner. This includes the 5 cores collected closest to the centerpoint where each of the 2 elevated concentrations were initially measured and the 3 cores collected near the effluent of the Saginaw Township WWTP. The samples were then extruded from the core tubes into the appropriate sample container. The samples were labeled, packaged, and shipped to Alta Analytical in El Dorado Hills, California in accordance with the *Sample Handling and Shipping Custody Procedures Field SOP* (CH2M HILL, 2004). The remaining portions of these cores, as well as the cores from which no samples were collected, remain frozen for potential future analysis.

Quality control samples collected as part of the sampling included one equipment blank. There was insufficient sediment volume within the top 0.3 foot of each sediment core to collect field duplicates and matrix spike/matrix spike duplicates. Table A-6 (Appendix A)

summarizes the QC sample type, event frequency, and QAPP specified frequency for QC sample collection.

The remaining portions of the segregated cores that were analyzed, along with the other 24 sediment cores that were not analyzed, are currently located in sample freezers at the sampling warehouse in Midland. The station locations (Station IDs), location coordinates, Sample IDs (where applicable), sample depth intervals, and associated analytical batches are summarized in Appendix A, Table A-5.

Investigation Derived Waste

Dedicated lexan core tubes were used for the collection of the sediment samples, so no decontamination water was used during the sampling. The excess sediment is currently frozen pending the need for analysis. Personal Protective Equipment (PPE) was containerized in trash bags and discarded in the office dumpster.

3.0 Laboratory Analysis

All soil and groundwater samples were prepared for analysis in accordance with SW-846, and analyzed for dioxins and furans by EPA Method 8290. All dioxins/furans analyses were performed at Alta Analytical Laboratory in El Dorado Hills, California. Analyses of samples collected during the summer 2004 sampling event were conducted in accordance with the project QAPP (CH2M HILL, 2004). Analysis of samples collected during fall 2003 were analyzed prior to implementation of the QAPP.

4.0 Validation

Analytical data from both sediment sampling events were all validated to Level III by CH2M HILL chemists. The findings of this validation are summarized below, and the full Validation Summaries are provided in Appendix B.

4.1 Fall 2003 Sediment Sampling Event

A review of the analytical data submitted for the fall 2003 sediment sampling event has been completed. The overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed. The validation review demonstrated that the analytical systems were generally in control and the data results can be used. The complete validation summary report is provided in Appendix B.

4.2 Summer 2004 Sediment Sampling Event

A review of the analytical data submitted for the summer 2004 sampling event has been completed. The overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed. The validation review demonstrated that the analytical systems were generally in control and the data results can be used. The complete validation summary report is provided in Appendix B.

5.0 Summary of Analytical Data

This section provides a brief summary of all analytical data collected during this investigation. The focus of this section is on the tabular presentation of data and factual observations made through its review. Figure 1 provides an overview of the locations sampled as well as the TEQ values found at each location.

These dioxin/furan data are presented as TEQ, by location for each media. Samples collected during this study were analyzed for all 17 of the 2, 3, 7, 8-substituted dioxin and furan congeners that are necessary to evaluate the TEQ. TEQs are calculated according to World Health Organization methodology (Van den Berg, et al., 1998), using toxicity equivalency factors for mammals. Laboratory non-detect results for individual congeners were factored into the TEQ calculation using a value of one-half the laboratory detection limit. Tables showing analytical results for all 17 congeners are presented in Appendix A, Table A-7 and A-8.

5.1 Fall 2003 Sediment Sampling Event

The surface 0.3 ft (10 cm) samples from all cores collected during the Fall 2003 were later analyzed (March 2004) for the purpose of evaluating the concentrations of dioxins/furans in surface sediments along the Tittabawassee River. Sediment dioxin/furan concentrations from this sampling event ranged from 2 to 9,312 parts per trillion (ppt) TEQ.

Two samples from this data set were of particular interest due to reported TEQs that were substantially higher than the other samples. These included samples SHL-02235 and THT-02245, which showed concentrations of 2,864 and 9,312 ppt TEQ, respectively. Sample SHL-02235 was collected approximately 1,000 feet upstream of the Saginaw Township WWTP outfall and THT-02245 was collected in the vicinity of Imerman Park. Note, however, that a second sample collected from the same location as THT-02245, but at a later date, showed a dioxin/furan concentration of 265 ppt TEQ. This location was sampled twice because a 2" diameter Lexan tube was first used for collection on November 12, 2003. It was later resampled on December 4, 2003 using a 2 ½" diameter Lexan tube for consistency with all other cores collected during this effort. All Fall 2003 sampling locations are shown on Figure 2.

5.2 Summer 2004 Sediment Sampling Event

The objective of the summer 2004 sampling was to collect sufficient data to evaluate sediment variability in the two sample locations from the fall 2003 study. Five samples were analyzed in the proximity of each of the areas with elevated TEQ. Figures 2A and 2B show the samples collected in the areas around the two elevated TEQ sample locations.

In fall 2003, the sediment sample collected from THT-02245 had a TEQ value of 9,312 ppt. In the samples collected near this location in the summer of 2004, TEQ values ranged from 10 to 71 ppt. TEQ values ranged from 15 to 517 ppt in the area surrounding SHL-02235 in samples collected in 2004. As noted above, the sample collected from location SHL-02235 had a calculated TEQ of 2,864 ppt. The calculated TEQ concentrations from the summer 2004 sampling event are provided in Table 2.

Three samples were analyzed in the vicinity of the Saginaw Township WWTP to evaluate potential impacts of the effluent on sediment dioxin/furan concentrations. Sample SHL-02818 located upstream of the WWTP had a TEQ concentration of 607 ppt, sample SHL-02817 located adjacent to the WWTP had a TEQ concentration of 32 ppt, and sample SHL-02816 located downstream of the WWTP had a TEQ concentration of 40 ppt.

6.0 Conclusions

Tittabawassee River surface sediment dioxin/furan TEQ concentrations appear to be highly variable and difficult to replicate. Sampling results collected in the areas around the elevated TEQ samples SHL-02235 and THT-02245 were at least an order-of-magnitude less than the original samples. Samples collected in the vicinity of the Saginaw Township WWTP were inconclusive in identifying any relationship between sediment TEQ concentrations and the outfall.

7.0 References

CH2M HILL. 2004. *Core Sediment Sampling Field SOP*.

CH2M HILL. 2004a. *Quality Assurance Project Plan.*

CH2M HILL. 2004b. *Sample Handling and Shipping Custody Procedures Field SOP.*

CH2M HILL. 2004c. *Sampling and Analysis Plan for Sediment Variability Sampling.*

LimnoTech, Inc. 2003. *Preliminary Flow/Solids Monitoring and Sediment Thickness Characterization.*

Van den Berg, M.; et al. 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. *Environmental Health Perspectives*. 106:775-792.

Tables

TABLE 1

TEQs in Sediment, Fall 2003 Sediment Sampling Event
Dow MOCA Sediment Variability Evaluation

Location ID	Field Sample ID	TEQ Result	Units
MIC-02251	111703-SED-02251-00.3	11.559	ng/kg
MIC-02252	120903-SED-02252-00.3	5.63519	ng/kg
MIC-02252	120903-SED-02270-00.3-D	7.06984	ng/kg
DOW-02253	111803-SED-02253-00.3	3.86812	ng/kg
DOW-02254	121103-SED-02254-00.3	2.87493	ng/kg
DOW-02254	121103-SED-02271-00.3-D	386.172	ng/kg
FRE-02247	120803-SED-02247-00.3	489.257	ng/kg
FRE-02248	120803-SED-02248-00.3	10.6356	ng/kg
FRE-02249	120903-SED-02249-00.3	11.367	ng/kg
FRE-02250	111403-SED-02250-00.3	15.5078	ng/kg
SHI-02232	112403-SED-02232-00.3	59.7323	ng/kg
SHL-02233	112503-SED-02233-00.3	17.8538	ng/kg
SHL-02234	112603-SED-02234-00.3	6.37545	ng/kg
SHL-02235	112603-SED-02235-00.3	2864.34	ng/kg
SHL-02236	110703-SED-02236-00.3	16.201	ng/kg
SHL-02237	120103-SED-02237-00.3	24.4635	ng/kg
SHL-02238	110703-SED-02238-00.3	37.3039	ng/kg
SHL-02239	120203-SED-02239-00.3	488.561	ng/kg
SHL-02240	120203-SED-02240-00.3	6.34143	ng/kg
SHL-02240	120203-SED-02269-00.3-D	1.47115	ng/kg
THT-02241	120303-SED-02241-00.3	117.341	ng/kg
THT-02242	120303-SED-02242-00.3	44.3601	ng/kg
THT-02243	120403-SED-02243-00.3	8.98756	ng/kg
THT-02244	120403-SED-02244-00.3	265.291	ng/kg
THT-02245	111203-SED-02245-00.3	9311.74	ng/kg
THT-02246	120503-SED-02246-00.3	143.926	ng/kg

TABLE 2

TEQs in Sediment, Summer 2004 Sediment Sampling Event
Dow MOCA Sediment Variability Evaluation

Location ID	Field Sample ID	TEQ Result	Units
SHL-02792	070804-SED-02792-00.3	109.192	ng/kg
SHL-02794	070704-SED-02794-00.3	516.883	ng/kg
SHL-02795	070704-SED-02795-00.3	484.957	ng/kg
SHL-02804	070704-SED-02804-00.3	21.3091	ng/kg
SHL-02816	070904-SED-02816-00.3	39.6688	ng/kg
SHL-02818	070904-SED-02818-00.3	607.256	ng/kg
THT-02775	070204-SED-02775-00.3	34.4805	ng/kg
THT-02776	070104-SED-02776-00.3	24.2967	ng/kg
THT-02777	070104-SED-02777-00.3	26.0669	ng/kg
THT-02779	070104-SED-02779-00.3	10.221	ng/kg
THT-02782	070104-SED-02782-00.3	70.7508	ng/kg
SHL-02793	070704-SED-02793-00.3	15.1562	ng/kg
SHL-02817	070904-SED-02817-00.3	32.3814	ng/kg

Figures

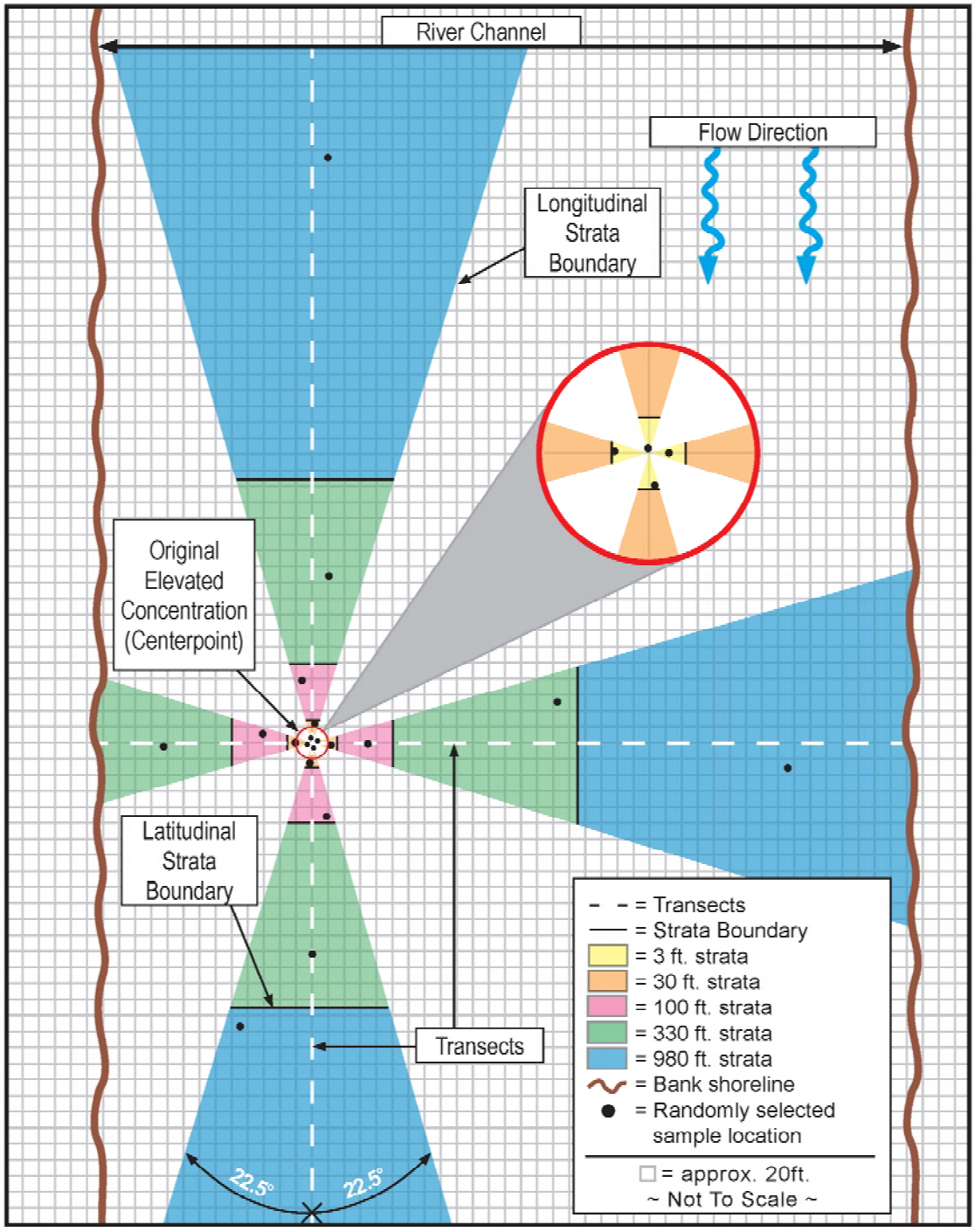

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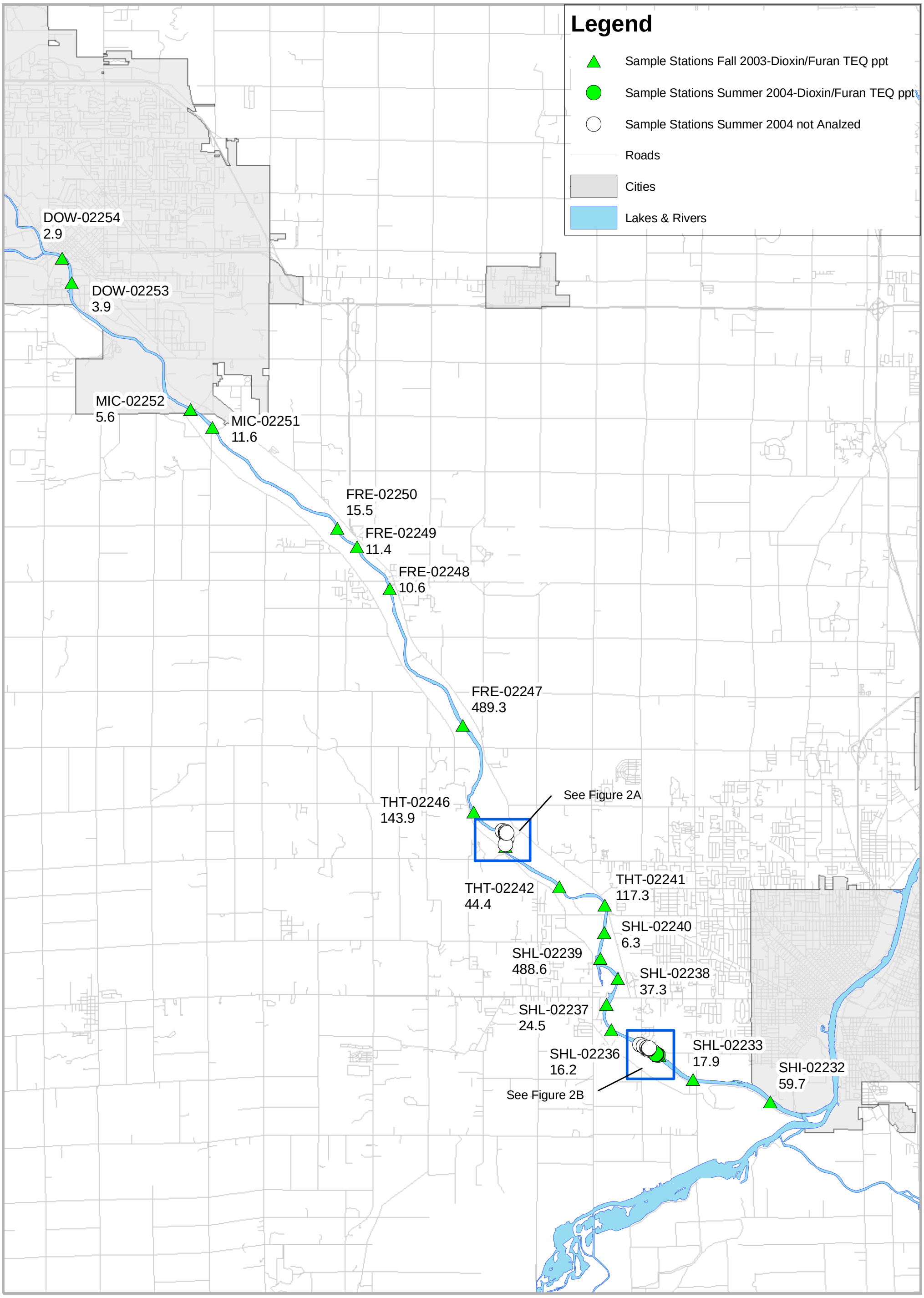
Figure 1
Schematic Diagram of Stratified Random Sampling Design

fig1_StratifiedRandomSampling_rev111201.pdf



N
W E
S

0 0.5 1 2 3 4 Miles

FIGURE 2
Dioxin/Furan TEQ Sediment Results Summary
Tittabawassee River Sediment Dioxin/Furan Concentration Variability Report
Dow Midland Offsite Corrective Actions Program

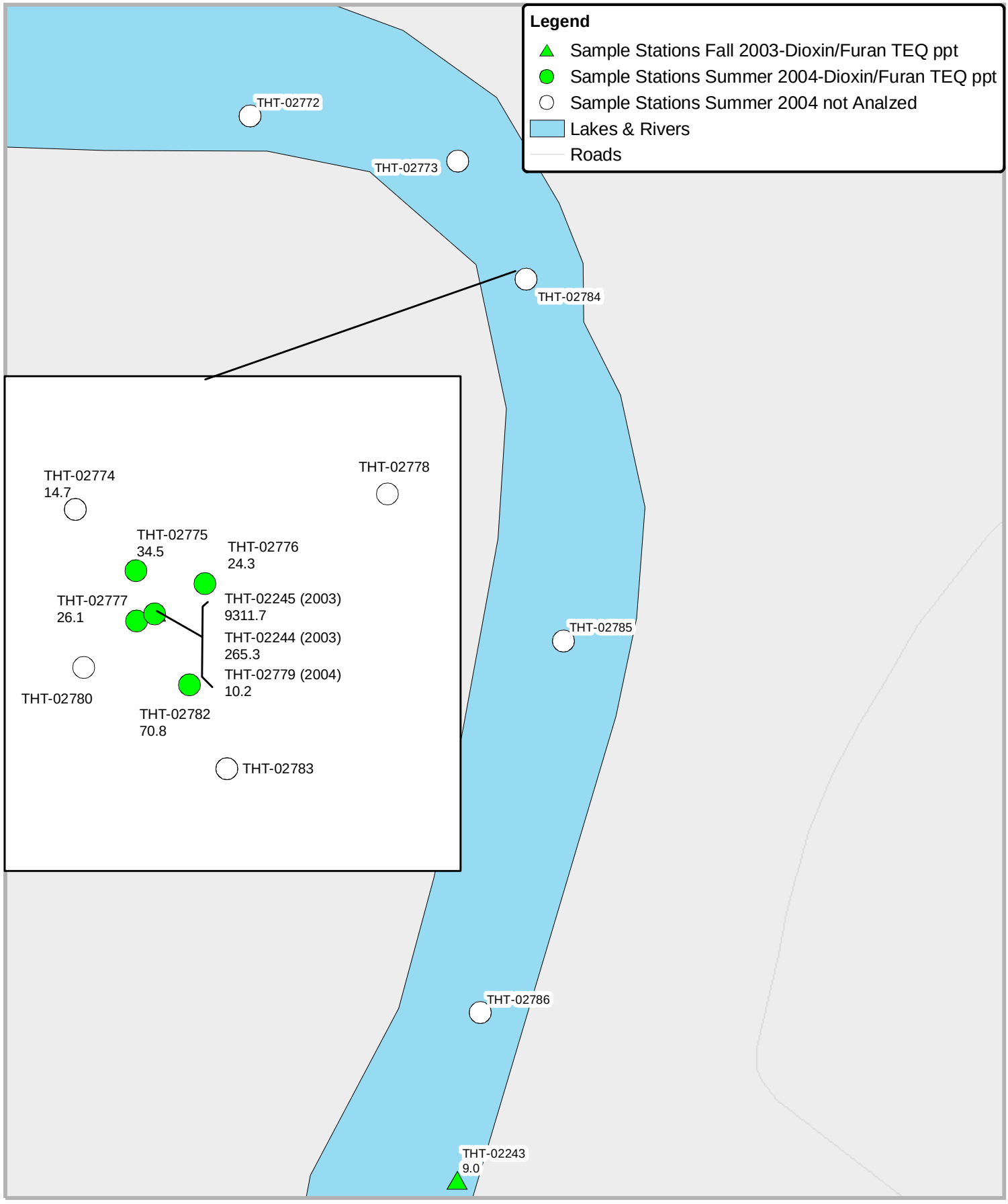


FIGURE 2A
Dioxin/Furan TEQ Sediment Results Summary
Tittabawassee River Sediment Dioxin/Furan Concentration Variability Report
Dow Midland Offsite Corrective Actions Program

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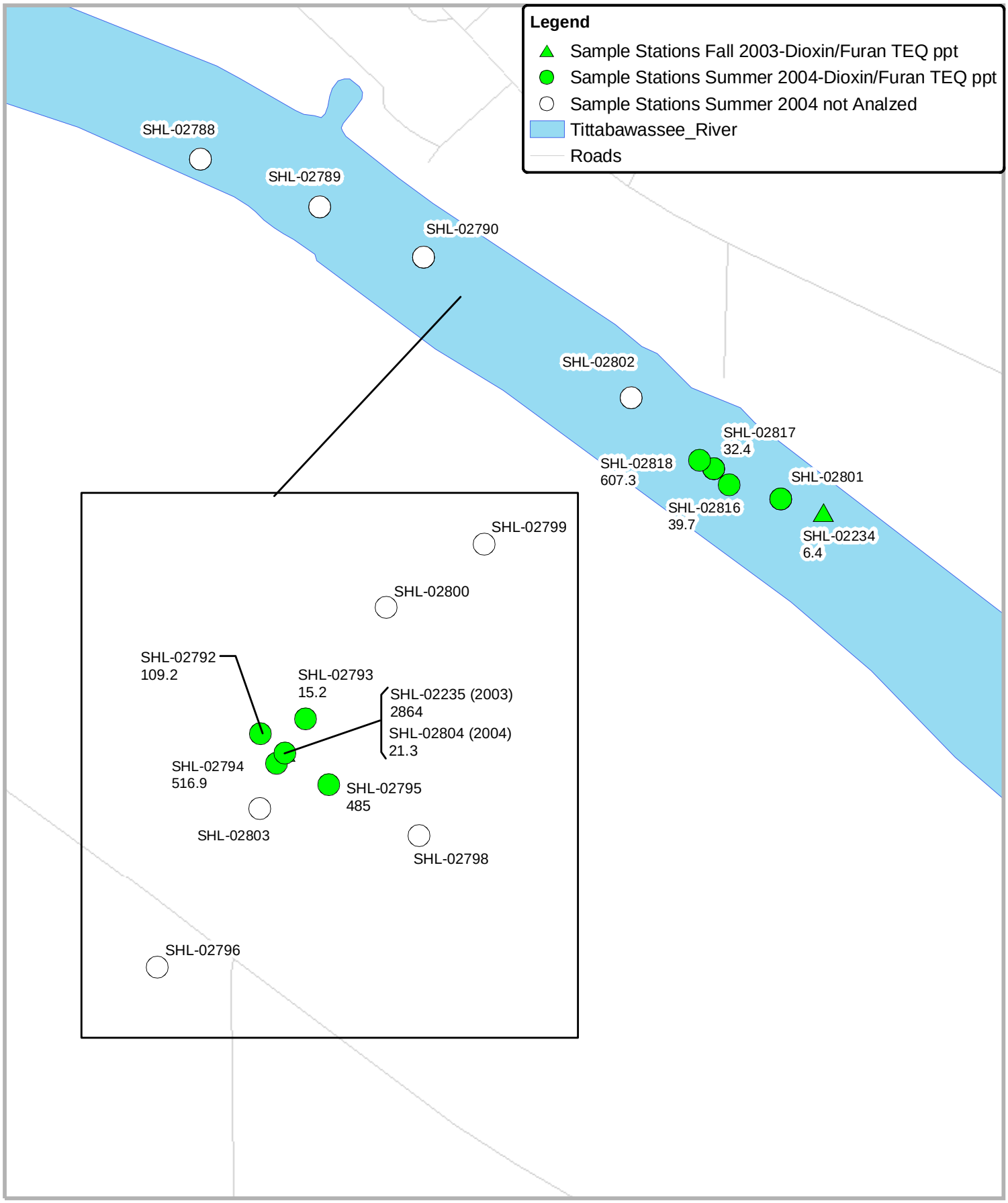

FIGURE 2B
Dioxin/Furan TEQ Sediment Results Summary
Tittabawassee River Sediment Dioxin/Furan Concentration Variability Report
Dow Midland Offsite Corrective Actions Program

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Appendix A
Sediment Variability Evaluation Station and Sample Summary, Fall 2003 and Summer 2004 Sampling Events

TABLE A-1
Summary of Field Measurements, Fall 2003 Sediment Sampling
Dow MOCA – Sediment Variability Sampling

Station ID	Water Depth (ft)	Sediment Penetrated (ft)	Sediment Recovered (ft)
DOW-02253	3	NR	3.67
DOW-02254	3.75	NR	3
FRE-02247	3	NR	3.5
FRE-02248	5	NR	2.42
FRE-02249	7.5	NR	3
FRE-02250	4	NR	3
MIC-02251	8.5	NR	1.58
MIC-02252	2.5	NR	4
SHI-02232	3	NR	1.8
SHL-02233	7	NR	2.3
SHL-02234	3	NR	3.9
SHL-02235	3.75	NR	3
SHL-02236	0	NR	3.8
SHL-02237	2	NR	3
SHL-02238	3.75	NR	3
SHL-02239	3	NR	3.4
SHL-02240	5.5	NR	0.8
THT-02241	8	NR	4.1
THT-02242	4	NR	2.25
THT-02243	2	NR	1.58
THT-02244	4	NR	2.3
THT-02245	5.5	NR	0.83
THT-02246	7.75	NR	1.3

NR = Not recorded. The sediment penetrated measurement was not recorded during the sampling events. Therefore, the percent recovery for each sediment core could also not be calculated.

TABLE A-2
Sample Station Summary, Fall 2003 Sediment Sampling Event
Dow MOCA – Sediment Variability Sampling

Station ID	Easting	Northing	Sample ID	Sample Depth Interval (ft.)	Analytical Batch
DOW-02253	13157192.7342	766520.9442	111803-SED-02253-00.3	0-0.3	24910
DOW-02254	13156296.7449	768859.1208	121103-SED-02254-00.3	0-0.3	24910
DOW-02254	13156296.7449	768859.1208	121103-SED-02271-00.3-D	0-0.3	24910
FRE-02247	13194571.4931	724241.5543	120803-SED-02247-00.3	0-0.3	24910
FRE-02248	13187602.1351	737309.1562	120803-SED-02248-00.3	0-0.3	24910
FRE-02249	13184435.0472	741301.3258	120903-SED-02249-00.3	0-0.3	24910
FRE-02250	13182577.8688	743063.6118	111403-SED-02250-00.3	0-0.3	24910
MIC-02251	13170630.6314	752677.3050	111703-SED-02251-00.3	0-0.3	24910
MIC-02252	13168563.4706	754393.7161	120903-SED-02252-00.3	0-0.3	24910
MIC-02252	13168563.4706	754393.7161	120903-SED-02270-00.3-D	0-0.3	24910
SHI-02232	13223920.7557	688304.6975	112403-SED-02232-00.3	0-0.3	24910
SHL-02233	13216565.9434	690433.6889	112603-SED-02233-00.3	0-0.3	24910
SHL-02234	13213354.3072	692700.0000	110603-SED-02234-00.3	0-0.3	24910
SHL-02235	13212293.1123	693347.1023	112603-SED-02235-00.3	0-0.3	24910
SHL-02236	13208752.6449	695191.5759	110703-SED-02236-00.3	0-0.3	24910
SHL-02237	13208282.3288	697605.9201	120103-SED-02237-00.3	0-0.3	24910
SHL-02238	13209376.1920	700057.8234	110703-SED-02238-00.3	0-0.3	24910
SHL-02239	13207696.6897	702001.3036	120203-SED-02239-00.3	0-0.3	24910
SHL-02240	13208069.3324	704439.9142	111003-SED-02240-00.3	0-0.3	24910
SHL-02240	13208069.3324	704439.9142	111003-SED-02269-00.3-D	0-0.3	24910
THT-02241	13208110.7113	707072.8293	120303-SED-02241-00.3	0-0.3	24910
THT-02242	13203781.9467	708825.7887	120303-SED-02242-00.3	0-0.3	24910
THT-02243	13198629.7319	712652.2814	120403-SED-02243-00.3	0-0.3	24910
THT-02244	13198710.7959	713955.4965	120403-SED-02244-00.3	0-0.3	24910
THT-02245	13198710.7959	713955.4965	111203-SED-02245-00.3	0-0.3	24910
THT-02246	13195597.0078	715954.5185	120503-SED-02246-00.3	0-0.3	24910

TABLE A-3
QC Sample Summary, Fall 2003 Sediment Sampling Event
Dow MOCA – Sediment Variability Sampling

QC Sample Type	Number of QC Samples Collected	Actual Event Frequency[1]	MOCA QAPP-Specified Frequency[1]
Trip Blanks	0[2]	One per cooler containing samples for VOC analysis	One per cooler containing samples for VOC analysis
Matrix Spikes/Matrix Spike Duplicates	0	0%	5.0%
Field Duplicates	3	13%	10%
Field Blanks	0[3]	0%	One per source of water used for decontamination
Equipment Blanks	0[3]	0%	5.0%

[1] = Frequency requirements are program wide frequencies and requirements, if not met above, will be met on a program wide basis.
[2] = Samples for VOC analysis were not collected as part of this sampling.
[3] = Not required since no equipment decontamination was performed.

TABLE A-4
Sediment Location Field Measurements, Summer 2004 Sampling Event
Dow MOCA – Sediment Variability Sampling

Station ID	Water Depth (ft)	Sediment Penetrated (ft)	Sediment Recovered (ft)	Percent Recovery
THT-02786	8	-	1.5	-
THT-02785	2	2.5	1.8	72%
THT-02784	-	-	3.55	-
THT-02783	3.4	-	3.15	-
THT-02782	3.75	4.25	3.95	93%
THT-02780	0.7	4	2.3	58%
THT-02777	3.0	5	3.9	78%
THT-02779	3.3	4.7	4	85%
THT-02776	5.0	4	3.45	86%
THT-02778	12.1	1.5	1.25	83%
THT-02781	10.2	1.5	1.2	80%
THT-02775	3.7	3	2.55	85%
THT-02774	2.85	3.5	3.1	89%
THT-02773	4.9	3.5	3.1	89%
THT-02772	6.6	4.5	4	89%
SHL-02801	4.5	3.5	3.25	93%
SHL-02802	3.5	3	2.75	92%
SHL-02797	4.25	3.5	3.6	1.03%
SHL-02798	4.5	3.5	3.25	93%
SHL-02795	4.9	3	3	100%
SHL-02794	5	-	2.7	-
SHL-02804	4.9	-	2.3	-
SHL-02799	6.1	2	1.25	63%
SHL-02800	5.25	5.25	2.4	46%
SHL-02793	5	2	1.5	75%
SHL-02803	4.3	3.75	3.75	100%
SHL-02796	3.5	-	2.5	-
SHL-02792	5.5	2.5	2.3	92%
SHL-02791	5.25	3.25	2.75	85%

TABLE A-4
Sediment Location Field Measurements, Summer 2004 Sampling Event
Dow MOCA – Sediment Variability Sampling

Station ID	Water Depth (ft)	Sediment Penetrated (ft)	Sediment Recovered (ft)	Percent Recovery
SHL-02790	5	2.4	1.5	63%
SHL-02789	3.75	2.5	2	80%
SHL-02788	4	3	2.4	80%
SHL-02816	3.5	3.5	2.75	79%
SHL-02817	3.75	3.7	3	81%
SHL-02818	3.25	4	2.6	65%

TABLE A-5
Sample Station Summary, Summer 2004 Sampling Event
Dow MOCA – Sediment Variability Sampling

Station ID	Easting	Northing	Sample ID	Sample Depth Interval (ft.)	Analytical Batch
SHL-02792	693353.12616497	13212285.1116673	070804-SED-02792-00.3	0-0.3	25125
SHL-02793	693357.84976816	13212299.7781498	070704-SED-02793-00.3	0-0.3	25125
SHL-02794	693343.57438604	13212290.4268347	070704-SED-02794-00.3	0-0.3	25125
SHL-02795	693336.76668264	13212307.2078060	070704-SED-02795-00.3	0-0.3	25125
SHL-02804	693346.86397802	13212293.1687503	070704-SED-02804-00.3	0-0.3	25125
THT-02775	713964.58143551	13198706.5813221	070204-SED-02775-00.3	0-0.3	25125
THT-02782	713939.66386607	13198718.3889385	070104-SED-02782-00.3	0-0.3	25125
THT-02777	713953.65192679	13198706.7642292	070104-SED-02777-00.3	0-0.3	25125
THT-02776	713961.83074148	13198721.7422425	070104-SED-02776-00.3	0-0.3	25125
THT-02779	713955.18826071	13198710.7701939	070104-SED-02779-00.3	0-0.3	25125
SHL-02816	692782.35192497	13213073.5298862	070904-SED-02816-00.3	0-0.3	25125
SHL-02817	692830.56134054	13213027.5010524	070904-SED-02817-00.3	0-0.3	25125
SHL-02818	692855.80703634	13212985.3440689	070904-SED-02818-00.3	0-0.3	25125
THT-02772	714151.79946485	13198338.0782178	No Sample Analyzed	-	-
THT-02773	714088.20198408	13198630.4481636	No Sample Analyzed	-	-
THT-02774	713978.03435600	13198693.3207889	No Sample Analyzed	-	-
THT-02778	713981.32467628	13198761.6696794	No Sample Analyzed	-	-
THT-02780	713943.39942298	13198695.1216002	No Sample Analyzed	-	-
THT-02783	713921.28492513	13198726.5621444	No Sample Analyzed	-	-
THT-02784	713800.96526312	13198742.8373075	No Sample Analyzed	-	-
THT-02785	713411.82483985	13198779.0463577	No Sample Analyzed	-	-
THT-02786	712887.96410452	13198662.3657224	No Sample Analyzed	-	-
SHL-02788	693754.91047615	13211495.1837964	No Sample Analyzed	-	-
SHL-02789	693611.97103738	13211850.8296897	No Sample Analyzed	-	-
SHL-02790	693461.33438473	13212161.2881326	No Sample Analyzed	-	-
SHL-02791	693358.73633790	13212267.0742629	No Sample Analyzed	-	-
SHL-02796	693277.93168073	13212251.8192349	No Sample Analyzed	-	-
SHL-02798	693320.19444965	13212336.2538792	No Sample Analyzed	-	-

TABLE A-5
Sample Station Summary, Summer 2004 Sampling Event
Dow MOCA – Sediment Variability Sampling

Station ID	Easting	Northing	Sample ID	Sample Depth Interval (ft.)	Analytical Batch
SHL-02799	693414.37502512	13212357.3489450	No Sample Analyzed	-	-
SHL-02800	693393.91413924	13212325.7287350	No Sample Analyzed	-	-
SHL-02801	692739.96895260	13213226.9889408	No Sample Analyzed	-	-
SHL-02802	693041.13002373	13212782.1136012	No Sample Analyzed	-	-
SHL-02803	693329.08892300	13212284.9284230	No Sample Analyzed	-	-
SHL-02796	693277.93168073	13212251.8192349	No Sample Analyzed	-	-

TABLE A-6
QC Sample Summary, Summer 2004 Sediment Sampling Event
Dow MOCA – Sediment Variability Sampling

QC Sample Type	Number of QC Samples Collected	Actual Event Frequency[1]	MOCA QAPP-Specified Frequency[1]
Trip Blanks	0[2]	One per cooler containing samples for VOC analysis	One per cooler containing samples for VOC analysis
Matrix Spikes/Matrix Spike Duplicates	0	0%	5.0%
Field Duplicates	0	0%	10%
Field Blanks	0[3]	0%	One per source of water used for decontamination
Equipment Blanks	1	20%	5.0%

[1] = Frequency requirements are program wide frequencies and requirements, if not met above, will be met on a program wide basis.
[2] = Samples for VOC analysis were not collected as part of this sampling.
[3] = A field blank was not collected since equipment decontamination was not performed.

Appendix B
Data Validation Summary Reports

Appendix B.1

Data Validation Summary – Fall 2003 Sampling Event

The purpose of this report is to present the results of the data validation process for the samples collected for the Dow Chemical Company LimnoTech Sampling Events at the Dow Chemical Company site in Midland, Michigan. The samples were collected between the dates of November 6, 2003 and March 10, 2004.

The specific samples and analytical fractions reviewed are summarized below in Table 1.

The Quality Control areas that were reviewed and the resulting findings are documented within each subsection that follows. These data were validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness based upon procedures described in the guidance documents such as the Environmental Protection Agency (EPA) National Functional Guidelines for Chlorinated Dioxin/Furan Data Review (EPA, 2002), and the Quality Control criteria provided in the Quality Assurance Project Plan (QAPP). Quality assurance/quality control (QA/QC) summary forms and data reports provided by the laboratory were reviewed.

Samples were submitted to Alta Analytical Laboratory, Inc., in El Dorado Hills, California for the dioxin/furan analyses.

Sample results that were not within the acceptance limits were appended with a primary qualifying flag by CH2M HILL, which consisted of a single- or double-letter code that indicated a possible problem with the data. The qualifying flags originated during the data review and validation processes. In addition, secondary "sub-qualifier" flags were also applied. The secondary qualifiers provide the reasoning behind the assignment of a qualifier flag to the data.

Attachment 1 lists the changes in data qualifiers, due to the validation process. It contains columns for the Laboratory Qualifier (Lab Qual) as received from the laboratory, primary qualifiers (Final Qual), and secondary qualifiers (Validation Reasons). The primary and secondary qualifiers are presented and defined below.

The following primary flags were used to qualify the data:

[=] Detected. The analyte was analyzed for and detected at the concentration shown.

[J] Estimated. The analyte was present but the reported value may not be accurate or precise.

[U] Undetected. The analyte was analyzed for but not detected above the method detection limit.

[UJ] Detection limit estimated. The analyte was analyzed for but qualified as not detected; the result is estimated.

[R] Rejected. The data is not useable.

The following Secondary Qualifier Codes were used to qualify the data.

Validation Reason	Definition
2SH	Second source calibration verification standard greater than the upper control limit
2SL	Second source calibration verification standard less than the lower control limit
ABH	Ambient blank concentration greater than the RL
ABL	Ambient blank concentration less than the RL
BKD	The result is qualified because the DDT and/or Endrin breakdown was greater than 20%.
CBKD	The result is qualified because the combined DDT/Endrin breakdown is greater than 30%.
CCBH	Continuing calibration blank concentration greater than the RL
CCBL	Continuing calibration blank concentration less than RL
CCC	CCC Failure
CCRRF	Continuing calibration relative response factor below the LCL
CCVF	Continuing Calibration not analyzed at the required frequency
CCVH	Continuing calibration recovery greater than upper control limit
CCVL	Continuing calibration recovery less than lower control limit
CF	Confirmation result
CFP	Confirmation precision exceeded
CO	Compounds were reported combined on one column
DL	Secondary dilution
EBH	Equipment blank concentration greater than the RL
EBL	Equipment blank concentration less than the RL
EMPC	Estimated Maximum Possible Concentration Reported
FBH	Field blank concentration greater than the RL

Validation Reason	Definition
FBL	Field blank concentration less than the RL
FD	Field duplicate exceeds RPD criteria
GPC	The results are qualified due to GPC calibration deficiencies.
HTA	Analytical Holding Time exceeded
HTP	Preparation Holding Time exceeded
IB	Result between the MDL and RL
ICBH	Initial calibration blank concentration greater than the RL
ICBL	Initial calibration blank concentration less than RL
ICR2	Initial calibration exceeded the R2 for first order regression
ICRR	Exceeds RSD criteria and initial calibration exceeded the R2 for first order regression
ICRRF	Initial calibration relative response factor below the LCL
ICRSD	Initial calibration RSD exceeded
ICSP	Single Point Initial Calibration used for Quantitation
ICVSH	Initial calibration verification recovery greater than upper control limit
ICVSL	Initial calibration verification recovery less than lower control limit
ISH	Internal standard response exceeded the UCL criteria
ISL	Internal standard response exceeded the LCL criteria
LBH	Laboratory blank contamination greater than the RL
LBL	Laboratory blank contamination less than the RL
LCSDH	LCSD recovery greater than criteria
LCSDL	LCSD recovery less than the criteria
LCSH	LCS recovery greater than criteria
LCSL	LCS recovery less than the criteria

Validation Reason	Definition
LCSP	LCS/LCSD RPD criteria exceeded
LDP	Laboratory Duplicate Precision out
LR	Linear range exceeded. Concentration above linear range.
MSA	Quantitated by the method of standard additions
MSALL	Global matrix spike flagging
MSAR2	method of standard additions R2 out
MSDH	Matrix spike duplicate recovery criteria greater than the upper limit
MSDL	Matrix spike duplicate recovery criteria less than the lower limit
MSDP	Matrix Spike Duplicate RPD criteria exceedance
MSH	Matrix spike recovery criteria greater than the upper limit
MSL	Matrix spike recovery criteria less than the lower limit
NMS	Not Site-specific Matrix Spike
PH	Sample pH out. Not properly preserved.
PRM	Result differs from Preliminary Result
PSH	Post spike recovery criteria greater than the upper limit
PSL	Post spike recovery criteria less than the lower limit
RA	Sample was reanalyzed
RE	Sample was re-extracted and reanalyzed
RT	Result is outside the laboratory determined retention time window
SCRN	Screening method and/or data
SDIL	Serial Dilution %D exceeds the upper control limit
SPCC	SPCC Failure
SSH	Surrogate recovery greater than upper limit

Validation Reason	Definition
SSL	Surrogate recovery less than lower limit
SSR	Surrogate spike recovery <10%
TBH	Trip blank concentration greater than the RL
TBL	Trip blank concentration less than the RL
TD	Total Concentration < Dissolved Concentration
TEMP	Cooler temperature out upon arrival
TIC	Tentatively identified compound
TN	GC/MS tune does not meet criteria
XCC	No Continuing Calibration analyzed in the analytical batch
X-DL	Data not used due to dilution; another value is more appropriate or data was not requested
XIC	No initial calibration analyzed in the analytical batch
XICVS	Initial calibration verification standard was not analyzed
XLCS	No LCS in the analytical batch
XLD	Laboratory Duplicate not reported
XMS	Matrix Spike not reported
XMSD	Matrix Spike Duplicate not reported
X-RE	Data not used due to reanalysis another value is more appropriate or data was not requested

TABLE B.1-1
Chemical Analytical Methods – Field and Quality Control Samples
Dow MOCA

Matrix	SDG	Lab Sample ID	Sample ID	Sample Alias	Sample Type	Date Collected	Dioxins
Sediment	24910	001	031004-SED-02255-00.0		N	03/10/2004	X
Sediment	24910	002	031004-SED-02260-00.0		N	03/10/2004	X
Sediment	24910	003	031204-SED-02268-00.0		N	03/12/2004	X
Sediment	24910	004	031004-SED-02262-00.0		N	03/10/2004	X
Sediment	24910	005	031204-SED-02267-00.0		N	03/12/2004	X
Sediment	24910	006	031004-SED-02264-00.0		N	03/10/2004	X
Sediment	24910	007	031004-SED-02266-00.0		N	03/10/2004	X
Sediment	24910	008	031004-SED-02265-00.0		N	03/10/2004	X
Sediment	24910	009	031004-SED-02263-00.0		N	03/10/2004	X
Sediment	24910	010	031004-SED-02261-00.0		N	03/10/2004	X
Sediment	24910	011	031004-SED-02256-00.0		N	03/10/2004	X
Sediment	24910	012	031004-SED-02258-00.0		N	03/10/2004	X
Sediment	24910	013	031004-SED-02257-00.0		N	03/10/2004	X
Sediment	24910	014	031004-SED-02259-00.0		N	03/10/2004	X
Sediment	24910	015	121103-SED-02271-00.3-D		FD	12/11/2003	X
Sediment	24910	016	110703-SED-02236-00.3		N	11/07/2003	X
Sediment	24910	017	120503-SED-02246-00.3		N	12/05/2003	X
Sediment	24910	018	110703-SED-02238-00.3		N	11/07/2003	X
Sediment	24910	019	120403-SED-02243-00.3		N	12/04/2003	X
Sediment	24910	020	120803-SED-02248-00.3		N	12/08/2003	X
Sediment	24910	021	120303-SED-02241-00.3		N	12/03/2003	X
Sediment	24910	022	120103-SED-02237-00.3		N	12/01/2003	X
Sediment	24910	023	120903-SED-02252-00.3		N	12/09/2003	X
Sediment	24910	024	111003-SED-02269-00.3-D		FD	11/10/2003	X
Sediment	24910	025	120903-SED-02270-00.3-D	120904-SED-02270-00.3-D	FD	12/09/2003	X
Sediment	24910	026	120903-SED-02249-00.3		N	12/09/2003	X
Sediment	24910	027	111703-SED-02251-00.3		N	11/17/2003	X
Sediment	24910	028	112603-SED-02233-00.3		N	11/26/2003	X
Sediment	24910	029	111803-SED-02253-00.3		N	11/18/2003	X
Sediment	24910	030	111803-SED-02254-00.3		N	11/18/2003	X

TABLE B.1-1
Chemical Analytical Methods – Field and Quality Control Samples
Dow MOCA

Matrix	SDG	Lab Sample ID	Sample ID	Sample Alias	Sample Type	Date Collected	Dioxins
Sediment	24910	031	120803-SED-02247-00.3		N	12/08/2003	X
Sediment	24910	032	120203-SED-02239-00.3		N	12/02/2003	X
Sediment	24910	033	111203-SED-02245-00.3		N	11/12/2003	X
Sediment	24910	034	111403-SED-02250-00.3		N	11/14/2003	X
Sediment	24910	035	120303-SED-02242-00.3		N	12/03/2003	X
Sediment	24910	036	112603-SED-02235-00.3		N	11/26/2003	X
Sediment	24910	037	112403-SED-02232-00.3		N	11/24/2003	X
Sediment	24910	038	111203-SED-02244-00.3		N	11/12/2003	X
Sediment	24910	039	110603-SED-02234-00.3		N	11/06/2003	X
Sediment	24910	040	111003-SED-02240-00.3		N	11/10/2003	X

SAMPLE TYPE CODE

N – Native Sample

FD – Field Duplicate

TABLE B.1-2
Changed Qualifiers

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
DIOXINS	8290	OCDD	24910	031004-SED-02263-00.3	24910-009	SED	4540	E	4540	J	pg/G	LR
DIOXINS	8290	1,2,3,4,6,7,8-HpCDD	24910	031004-SED-02258-00.3	24910-012	SED	2590	E	2590	J	pg/G	LR
DIOXINS	8290	OCDD	24910	031004-SED-02258-00.3	24910-012	SED	23300	E	23300	J	pg/G	LR
DIOXINS	8290	OCDF	24910	031004-SED-02258-00.3	24910-012	SED	8170	E	8170	J	pg/G	LR
DIOXINS	8290	Total HpCDD	24910	031004-SED-02258-00.3	24910-012	SED	4140	E	4140	J	pg/G	LR
DIOXINS	8290	Total TCDF	24910	031004-SED-02258-00.3	24910-012	SED	5350	E	5350	J	pg/G	LR
DIOXINS	8290	Total TCDF	24910	031004-SED-02259-00.3	24910-014	SED	3400	E	3400	J	pg/G	LR
DIOXINS	8290	OCDD	24910	121103-SED-02271-00.3-D	24910-015	SED	3790	E	3790	J	pg/G	LR
DIOXINS	8290	Total TCDF	24910	121103-SED-02271-00.3-D	24910-015	SED	2410	E	2410	J	pg/G	LR
DIOXINS	8290	Total TCDF	24910	120503-SED-02246-00.3	24910-017	SED	1370	E	1370	J	pg/G	LR
DIOXINS	8290	OCDD	24910	120303-SED-02241-00.3	24910-021	SED	7640	E	7640	J	pg/G	LR
DIOXINS	8290	1,2,3,4,6,7,8,-HpCDF	24910	120303-SED-02241-00.3	24910-021	SED	4180	E	4180	J	pg/G	LR
DIOXINS	8290	1,2,3,7,8,-PeCDF	24910	111203-SED-02245-00.3	24910-033	SED	14200	E	14200	J	pg/G	LR
DIOXINS	8290	2,3,4,7,8,-PeCDF	24910	111203-SED-02245-00.3	24910-033	SED	10900	E	10900	J	pg/G	LR
DIOXINS	8290	1,2,3,4,7,8 -HxCDF	24910	111203-SED-02245-00.3	24910-033	SED	8630	E	8630	J	pg/G	LR
DIOXINS	8290	1,2,3,7,8,-PeCDF	24910	112603-SED-02235-00.3	24910-036	SED	3180	E	3180	J	pg/G	LR
DIOXINS	8290	2,3,4,7,8,-PeCDF	24910	112603-SED-02235-00.3	24910-036	SED	3350	E	3350	J	pg/G	LR

Dioxin/Furan Parameters

Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure for the dioxin/furan data.

- **Holding Times –** The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank Samples –** Method blanks and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Labeled Standard and Cleanup Standard Recoveries –** Labeled Standard and Cleanup Standard are added to each sample. The recoveries are used to monitor laboratory and method performance, and possible matrix interference.
- **Lab Control Sample/Lab Control Sample Duplicate (LCS/LCSD) –** These samples are a "controlled matrix," in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples –** Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **Field Duplicate Samples –** These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **GC/MS Tuning –** The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution. In addition, the column performance check and window defining mix summaries are evaluated.
- **Initial Calibration –** The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration –** The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds, including retention times and abundance ratios.
- **Internal Standards –** The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.

- **Second Column Confirmation –** Second column confirmation is evaluated when a secondary analysis is required due to interferences or co-elution.

Dioxin/Furan Analyses by SW-846 8290

The QA/QC parameters for dioxin/furan analyses by SW-846 8290 for all of the samples were within acceptable control limits, except as noted below:

Linear Range

There were selected results in which the sample concentration exceeded the concentration of the calibration curve. However, the laboratory does not dilute and re-analyze dioxin/furan samples unless the signal saturates the instrument detector. The signal did not saturate the detector and linearity was maintained. Therefore, the sample results were qualified "J," as estimated.

The sample results qualified due to linear range exceedances are listed in Attachment 1 with a Validation Note of "LR."

Rejected Data

No data were rejected based upon the validation process for this sampling event.

Conclusion

A review of the analytical data submitted for the LimnoTech Sampling Events, by LimnoTech has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed. The validation review demonstrated that the analytical systems were generally in control and the data results can be used in the decision making process.

Appendix B.2

Data Validation Summary – Summer 2004 Sampling

The purpose of this report is to present the results of the data validation process for the samples collected for the Dow Chemical Company Sediment Variability Study at the Dow Chemical Company site in Midland, Michigan. The samples were collected between the dates of July 1 and July 9, 2004.

The specific samples and analytical fractions reviewed are summarized below in Table 1.

The Quality Control areas that were reviewed and the resulting findings are documented within each subsection that follows. These data were validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness based upon procedures described in the guidance documents such as the Environmental Protection Agency (EPA) National Functional Guidelines for Chlorinated Dioxin/Furan Data Review (EPA 2002), and the Quality Control criteria provided in the Quality Assurance Project Plan (QAPP). Quality assurance/quality control (QA/QC) summary forms and data reports provided by the laboratory were reviewed.

Samples were submitted to Alta Analytical Laboratory, Inc., in El Dorado Hills, California for the dioxin/furan analyses.

A primary qualifying flag was appended by CH2M HILL to those sample results that were not within the acceptance limits. The primary qualifying flag consisted of a single- or double-letter code that indicated a possible problem with the data. The need to apply qualifying flags was identified during the data review and validation processes.

In addition to primary qualifying flags, secondary "sub-qualifier" flags were also applied. The secondary qualifiers provide the reasoning behind the assignment of a primary qualifier flag to the data.

Attachment 1 lists the changes in data qualifiers, due to the validation process. It contains columns for the Laboratory Qualifier (Lab Qual) as received from the laboratory, primary qualifiers (Final Qual), and secondary qualifiers (Validation Reasons). The primary and secondary qualifiers are presented and defined below.

The following primary flags were used to qualify the data:

[=] Detected. The analyte was analyzed for and detected at the concentration shown.

[J] Estimated. The analyte was present but the reported value may not be accurate or precise.

[U] Undetected. The analyte was analyzed for but not detected above the method detection limit.

[UJ] Detection limit estimated. The analyte was analyzed for but qualified as not detected; the result is estimated.

[R] Rejected. The data is not useable.

The following Secondary Qualifier Codes were used to qualify the data.

Validation Reason	Definition
2SH	Second source calibration verification standard greater than the upper control limit
2SL	Second source calibration verification standard less than the lower control limit
ABH	Ambient blank concentration greater than the RL
ABL	Ambient blank concentration less than the RL
BKD	The result is qualified because the DDT and/or Endrin breakdown was greater than 20%.
CBKD	The result is qualified because the combined DDT/Endrin breakdown is greater than 30%.
CCBH	Continuing calibration blank concentration greater than the RL
CCBL	Continuing calibration blank concentration less than RL
CCC	CCC Failure
CCRRF	Continuing calibration relative response factor below the LCL
CCVF	Continuing Calibration not analyzed at the required frequency
CCVH	Continuing calibration recovery greater than upper control limit
CCVL	Continuing calibration recovery less than lower control limit
CF	Confirmation result
CFP	Confirmation precision exceeded
CO	Compounds were reported combined on one column
DL	Secondary dilution
EBH	Equipment blank concentration greater than the RL
EBL	Equipment blank concentration less than the RL
EMPC	Estimated Maximum Possible Concentration Reported
FBH	Field blank concentration greater than the RL

Validation Reason	Definition
FBL	Field blank concentration less than the RL
FD	Field duplicate exceeds RPD criteria
GPC	The results are qualified due to GPC calibration deficiencies.
HTA	Analytical Holding Time exceeded
HTP	Preparation Holding Time exceeded
IB	Result between the MDL and RL
ICBH	Initial calibration blank concentration greater than the RL
ICBL	Initial calibration blank concentration less than RL
ICR2	Initial calibration exceeded the R2 for first order regression
ICRR	Exceeds RSD criteria and initial calibration exceeded the R2 for first order regression
ICRRF	Initial calibration relative response factor below the LCL
ICRSD	Initial calibration RSD exceeded
ICSP	Single Point Initial Calibration used for Quantitation
ICVSH	Initial calibration verification recovery greater than upper control limit
ICVSL	Initial calibration verification recovery less than lower control limit
ISH	Internal standard response exceeded the UCL criteria
ISL	Internal standard response exceeded the LCL criteria
LBH	Laboratory blank contamination greater than the RL
LBL	Laboratory blank contamination less than the RL
LCSDH	LCSD recovery greater than criteria
LCSDL	LCSD recovery less than the criteria
LCSH	LCS recovery greater than criteria

Validation Reason	Definition
LCSL	LCS recovery less than the criteria
LCSP	LCS/LCSD RPD criteria exceeded
LDP	Laboratory Duplicate Precision out
LR	Linear range exceeded. Concentration above linear range.
MSA	Quantitated by the method of standard additions
MSALL	Global matrix spike flagging
MSAR2	method of standard additions R2 out
MSDH	Matrix spike duplicate recovery criteria greater than the upper limit
MSDL	Matrix spike duplicate recovery criteria less than the lower limit
MSDP	Matrix Spike Duplicate RPD criteria exceedance
MSH	Matrix spike recovery criteria greater than the upper limit
MSL	Matrix spike recovery criteria less than the lower limit
NMS	Not Site-specific Matrix Spike
PH	Sample pH out. Not properly preserved.
PRM	Result differs from Preliminary Result
PSH	Post spike recovery criteria greater than the upper limit
PSL	Post spike recovery criteria less than the lower limit
RA	Sample was reanalyzed
RE	Sample was re-extracted and reanalyzed
RT	Result is outside the laboratory determined retention time window
SCRN	Screening method and/or data
SDIL	Serial Dilution %D exceeds the upper control limit

Validation Reason	Definition
SPCC	SPCC Failure
SSH	Surrogate recovery greater than upper limit
SSL	Surrogate recovery less than lower limit
SSR	Surrogate spike recovery <10%
TBH	Trip blank concentration greater than the RL
TBL	Trip blank concentration less than the RL
TD	Total Concentration < Dissolved Concentration
TEMP	Cooler temperature out upon arrival
TIC	Tentatively identified compound
TN	GC/MS tune does not meet criteria
XCC	No Continuing Calibration analyzed in the analytical batch
X-DL	Data not used due to dilution; another value is more appropriate or data was not requested
XIC	No initial calibration analyzed in the analytical batch
XICVS	Initial calibration verification standard was not analyzed
XLCS	No LCS in the analytical batch
XLD	Laboratory Duplicate not reported
XMS	Matrix Spike not reported
XMSD	Matrix Spike Duplicate not reported
X-RE	Data not used due to reanalysis another value is more appropriate or data was not requested

TABLE B.2-1
Chemical Analytical Methods – Field and Quality Control Samples
Dow MOCA

Matrix	SDG	Lab Sample ID	Sample ID	Sample Alias	Sample Type	Date Collected	SW8290 Dioxins
Sediment	25125	001	070204-SED-02775-00.3	THT-02775	N	07/02/2004	X
Sediment	25125	002	070104-SED-02782-00.3	THT-02782	N	07/01/2004	X
Sediment	25125	003	070104-SED-02777-00.3	THT-02777	N	07/01/2004	X
Sediment	25125	004	070104-SED-02776-00.3	THT-02776	N	07/01/2004	X
Sediment	25125	005	070104-SED-02779-00.3	THT-02779	N	07/01/2004	X
Sediment	25125	006	070704-SED-02795-00.3	SHL-02795	N	07/07/2004	X
Sediment	25125	007	070704-SED-02804-00.3	SHL-02804	N	07/07/2004	X
Sediment	25125	008	070704-SED-02794-00.3	SHL-02794	N	07/07/2004	X
Sediment	25125	009	070704-SED-02793-00.3	SHL-02793	N	07/07/2004	X
Sediment	25125	010	070804-SED-02792-00.3	SHL-02792	N	07/08/2004	X
Water	25125	011	070804-QCW-02815-R		EB	07/08/2004	X
Sediment	25125	012	070904-SED-2816-00.3	SHL-2816	N	07/09/2004	X
Sediment	25125	013	070904-SED-2817-00.3	SHL-2817	N	07/09/2004	X
Sediment	25125	014	070904-SED-2818-00.3	SHL-2818	N	07/09/2004	X

SAMPLE TYPE CODE

N – Native Sample

EB – Equipment Blank

TABLE B.2-2
Changed Qualifiers

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
DIOXINS	8290	2,3,7,8-TCDF	25125	070704-SED-02795-00.3	006	SED	1740	E	1740	J	pg/G	LR
DIOXINS	8290	Total TCDF	25125	070704-SED-02795-00.3	006	SED	3800	E	3800	J	pg/G	LR
DIOXINS	8290	2,3,7,8-TCDF	25125	070704-SED-02794-00.3	008	SED	1200	E	1200	J	pg/G	LR
DIOXINS	8290	Total TCDF	25125	070704-SED-02794-00.3	008	SED	3340	E	3340	J	pg/G	LR
DIOXINS	8290	OCDD	25125	070904-SED-2817-00.3	013	SED	12900	E	12900	J	pg/G	LR
DIOXINS	8290	2,3,7,8-TCDF	25125	070904-SED-2818-00.3	014	SED	2730	E	2730	J	pg/G	LR
DIOXINS	8290	Total TCDF	25125	070904-SED-2818-00.3	014	SED	6530	E	6530	J	pg/G	LR

Dioxin/Furan Parameters

Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure for the dioxin/furan data.

- **Holding Times –** The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank Samples –** Method blanks and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Labeled Standard and Cleanup Standard Recoveries –** Labeled Standard and Cleanup Standard are added to each sample. The recoveries are used to monitor laboratory and method performance, and possible matrix interference.
- **Lab Control Sample/Lab Control Sample Duplicate (LCS/LCSD) –** These samples are a "controlled matrix," in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples –** Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **Field Duplicate Samples –** These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **GC/MS Tuning –** The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution. In addition, the column performance check and window defining mix summaries are evaluated.
- **Initial Calibration –** The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration –** The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds, including retention times and abundance ratios.
- **Internal Standards –** The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.

- **Second Column Confirmation –** Second column confirmation is evaluated when a secondary analysis is required due to interferences or co-elution.

Dioxin/Furan Analyses by SW-846 8290

The QA/QC parameters for dioxin/furan analyses by SW-846 8290 for all of the samples were within acceptable control limits, except as noted below:

Linear Range

There were selected results in which the sample concentration exceeded the concentration of the calibration curve. However, the laboratory does not dilute and re-analyze dioxin/furan samples unless the signal saturates the instrument detector. The signal did not saturate the detector and linearity was maintained. Therefore, the sample results were qualified "J," as estimated.

The sample results qualified due to linear range exceedances are listed in Attachment 1 with a Validation Note of "LR."

Rejected Data

No data were rejected based upon the validation process for this sampling event.

Conclusion

A review of the analytical data submitted for the Sediment Variability Study has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed. The validation review demonstrated that the analytical systems were generally in control and the data results can be used in the decision making process.

Appendix C
Dioxin/Furan Congener-Specific Sediment Sample Results

TABLE C-1

Sample Results for Specific Congeners, Fall 2003 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
110703-SED-02236-00.3	1746-01-6	2,3,7,8-TCDD	1.35	pg/g	=
110703-SED-02236-00.3	40321-76-4	1,2,3,7,8-PECDD	0.958	pg/g	=
110703-SED-02236-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.811	pg/g	=
110703-SED-02236-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.94	pg/g	U
110703-SED-02236-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.83	pg/g	=
110703-SED-02236-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	15	pg/g	=
110703-SED-02236-00.3	3268-87-9	OCDD	116	pg/g	=
110703-SED-02236-00.3	51207-31-9	2,3,7,8-TCDF	44	pg/g	=
110703-SED-02236-00.3	57117-41-6	1,2,3,7,8-PECDF	13.3	pg/g	=
110703-SED-02236-00.3	57117-31-4	2,3,4,7,8-PECDF	13.1	pg/g	=
110703-SED-02236-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	9.48	pg/g	=
110703-SED-02236-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	3.04	pg/g	=
110703-SED-02236-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.86	pg/g	=
110703-SED-02236-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	2.34	pg/g	=
110703-SED-02236-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	17.1	pg/g	=
110703-SED-02236-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.78	pg/g	U
110703-SED-02236-00.3	39001-02-0	OCDF	33.7	pg/g	=
110703-SED-02238-00.3	1746-01-6	2,3,7,8-TCDD	2.55	pg/g	=
110703-SED-02238-00.3	40321-76-4	1,2,3,7,8-PECDD	1.35	pg/g	=
110703-SED-02238-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.431	pg/g	U
110703-SED-02238-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	3	pg/g	=
110703-SED-02238-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	1.05	pg/g	=
110703-SED-02238-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	39.4	pg/g	=
110703-SED-02238-00.3	3268-87-9	OCDD	296	pg/g	=
110703-SED-02238-00.3	51207-31-9	2,3,7,8-TCDF	105	pg/g	=
110703-SED-02238-00.3	57117-41-6	1,2,3,7,8-PECDF	33.8	pg/g	=
110703-SED-02238-00.3	57117-31-4	2,3,4,7,8-PECDF	32.8	pg/g	=
110703-SED-02238-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	23.1	pg/g	=
110703-SED-02238-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	5.15	pg/g	=
110703-SED-02238-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	3.22	pg/g	=
110703-SED-02238-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	3.68	pg/g	=
110703-SED-02238-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	40.7	pg/g	=
110703-SED-02238-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	3.5	pg/g	=
110703-SED-02238-00.3	39001-02-0	OCDF	67.5	pg/g	=
111203-SED-02245-00.3	1746-01-6	2,3,7,8-TCDD	6.66	pg/g	=
111203-SED-02245-00.3	40321-76-4	1,2,3,7,8-PECDD	6.09	pg/g	U
111203-SED-02245-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	1.86	pg/g	=
111203-SED-02245-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	6.89	pg/g	=
111203-SED-02245-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	2.02	pg/g	=
111203-SED-02245-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	47.2	pg/g	=
111203-SED-02245-00.3	3268-87-9	OCDD	311	pg/g	=
111203-SED-02245-00.3	51207-31-9	2,3,7,8-TCDF	17900	pg/g	=
111203-SED-02245-00.3	57117-41-6	1,2,3,7,8-PECDF	14200	pg/g	J
111203-SED-02245-00.3	57117-31-4	2,3,4,7,8-PECDF	10900	pg/g	J
111203-SED-02245-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	8630	pg/g	J
111203-SED-02245-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	1900	pg/g	=
111203-SED-02245-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	977	pg/g	=
111203-SED-02245-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	1860	pg/g	=
111203-SED-02245-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	961	pg/g	=
111203-SED-02245-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	412	pg/g	=
111203-SED-02245-00.3	39001-02-0	OCDF	222	pg/g	=
111403-SED-02250-00.3	1746-01-6	2,3,7,8-TCDD	0.891	pg/g	=
111403-SED-02250-00.3	40321-76-4	1,2,3,7,8-PECDD	0.526	pg/g	=
111403-SED-02250-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.39	pg/g	U
111403-SED-02250-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.15	pg/g	=
111403-SED-02250-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.609	pg/g	U
111403-SED-02250-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	15.2	pg/g	=
111403-SED-02250-00.3	3268-87-9	OCDD	119	pg/g	=
111403-SED-02250-00.3	51207-31-9	2,3,7,8-TCDF	44.7	pg/g	=
111403-SED-02250-00.3	57117-41-6	1,2,3,7,8-PECDF	14.9	pg/g	=

TABLE C-1

Sample Results for Specific Congeners, Fall 2003 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
111403-SED-02250-00.3	57117-31-4	2,3,4,7,8-PECDF	12.8	pg/g	=
111403-SED-02250-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	11.7	pg/g	=
111403-SED-02250-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	2.74	pg/g	=
111403-SED-02250-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.8	pg/g	=
111403-SED-02250-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	2.14	pg/g	=
111403-SED-02250-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	28.5	pg/g	=
111403-SED-02250-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	2.03	pg/g	=
111403-SED-02250-00.3	39001-02-0	OCDF	36.8	pg/g	=
111703-SED-02251-00.3	1746-01-6	2,3,7,8-TCDD	0.37	pg/g	=
111703-SED-02251-00.3	40321-76-4	1,2,3,7,8-PECDD	0.269	pg/g	=
111703-SED-02251-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.347	pg/g	=
111703-SED-02251-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	0.923	pg/g	=
111703-SED-02251-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.369	pg/g	U
111703-SED-02251-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	11.3	pg/g	=
111703-SED-02251-00.3	3268-87-9	OCDD	113	pg/g	=
111703-SED-02251-00.3	51207-31-9	2,3,7,8-TCDF	29.4	pg/g	=
111703-SED-02251-00.3	57117-41-6	1,2,3,7,8-PECDF	11.5	pg/g	=
111703-SED-02251-00.3	57117-31-4	2,3,4,7,8-PECDF	11.3	pg/g	=
111703-SED-02251-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	7.93	pg/g	=
111703-SED-02251-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	3.18	pg/g	=
111703-SED-02251-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.18	pg/g	=
111703-SED-02251-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	1.46	pg/g	=
111703-SED-02251-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	9.54	pg/g	=
111703-SED-02251-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.26	pg/g	=
111703-SED-02251-00.3	39001-02-0	OCDF	22.3	pg/g	=
111803-SED-02253-00.3	1746-01-6	2,3,7,8-TCDD	0.242	pg/g	=
111803-SED-02253-00.3	40321-76-4	1,2,3,7,8-PECDD	0.334	pg/g	U
111803-SED-02253-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.315	pg/g	U
111803-SED-02253-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	0.455	pg/g	=
111803-SED-02253-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.32	pg/g	U
111803-SED-02253-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	4.78	pg/g	=
111803-SED-02253-00.3	3268-87-9	OCDD	35.3	pg/g	=
111803-SED-02253-00.3	51207-31-9	2,3,7,8-TCDF	3.66	pg/g	=
111803-SED-02253-00.3	57117-41-6	1,2,3,7,8-PECDF	3.99	pg/g	=
111803-SED-02253-00.3	57117-31-4	2,3,4,7,8-PECDF	2.18	pg/g	=
111803-SED-02253-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	12.1	pg/g	=
111803-SED-02253-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	2.07	pg/g	=
111803-SED-02253-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	0.649	pg/g	=
111803-SED-02253-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	1.02	pg/g	=
111803-SED-02253-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	6.25	pg/g	=
111803-SED-02253-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	2.7	pg/g	=
111803-SED-02253-00.3	39001-02-0	OCDF	16.4	pg/g	=
112403-SED-02232-00.3	1746-01-6	2,3,7,8-TCDD	1.74	pg/g	=
112403-SED-02232-00.3	40321-76-4	1,2,3,7,8-PECDD	1.03	pg/g	=
112403-SED-02232-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.514	pg/g	=
112403-SED-02232-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.86	pg/g	=
112403-SED-02232-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.73	pg/g	=
112403-SED-02232-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	16.6	pg/g	=
112403-SED-02232-00.3	3268-87-9	OCDD	117	pg/g	=
112403-SED-02232-00.3	51207-31-9	2,3,7,8-TCDF	179	pg/g	=
112403-SED-02232-00.3	57117-41-6	1,2,3,7,8-PECDF	66.7	pg/g	=
112403-SED-02232-00.3	57117-31-4	2,3,4,7,8-PECDF	60.9	pg/g	=
112403-SED-02232-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	28.1	pg/g	=
112403-SED-02232-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	6.96	pg/g	=
112403-SED-02232-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	5.06	pg/g	=
112403-SED-02232-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	5.67	pg/g	=
112403-SED-02232-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	18.6	pg/g	=
112403-SED-02232-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	2.19	pg/g	=
112403-SED-02232-00.3	39001-02-0	OCDF	22.9	pg/g	=
112503-SED-02233-00.3	1746-01-6	2,3,7,8-TCDD	1.09	pg/g	=

TABLE C-1

Sample Results for Specific Congeners, Fall 2003 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
112503-SED-02233-00.3	40321-76-4	1,2,3,7,8-PECDD	0.648	pg/g	=
112503-SED-02233-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.502	pg/g	U
112503-SED-02233-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.19	pg/g	=
112503-SED-02233-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.507	pg/g	U
112503-SED-02233-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	15.5	pg/g	=
112503-SED-02233-00.3	3268-87-9	OCDD	157	pg/g	=
112503-SED-02233-00.3	51207-31-9	2,3,7,8-TCDF	72.1	pg/g	=
112503-SED-02233-00.3	57117-41-6	1,2,3,7,8-PECDF	12.9	pg/g	=
112503-SED-02233-00.3	57117-31-4	2,3,4,7,8-PECDF	13.1	pg/g	=
112503-SED-02233-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	6.04	pg/g	=
112503-SED-02233-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	2.81	pg/g	=
112503-SED-02233-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.51	pg/g	=
112503-SED-02233-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	1.16	pg/g	=
112503-SED-02233-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	20.9	pg/g	=
112503-SED-02233-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.08	pg/g	U
112503-SED-02233-00.3	39001-02-0	OCDF	42.7	pg/g	=
112603-SED-02234-00.3	1746-01-6	2,3,7,8-TCDD	0.552	pg/g	=
112603-SED-02234-00.3	40321-76-4	1,2,3,7,8-PECDD	0.385	pg/g	=
112603-SED-02234-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.314	pg/g	U
112603-SED-02234-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	0.613	pg/g	=
112603-SED-02234-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.45	pg/g	U
112603-SED-02234-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	9.31	pg/g	=
112603-SED-02234-00.3	3268-87-9	OCDD	76.6	pg/g	=
112603-SED-02234-00.3	51207-31-9	2,3,7,8-TCDF	18.5	pg/g	=
112603-SED-02234-00.3	57117-41-6	1,2,3,7,8-PECDF	4.7	pg/g	=
112603-SED-02234-00.3	57117-31-4	2,3,4,7,8-PECDF	4.89	pg/g	=
112603-SED-02234-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	3.26	pg/g	=
112603-SED-02234-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	1.02	pg/g	=
112603-SED-02234-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	0.738	pg/g	=
112603-SED-02234-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	0.608	pg/g	U
112603-SED-02234-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	16.6	pg/g	=
112603-SED-02234-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	0.814	pg/g	=
112603-SED-02234-00.3	39001-02-0	OCDF	18.5	pg/g	=
112603-SED-02235-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	87.2	pg/g	=
112603-SED-02235-00.3	39001-02-0	OCDF	722	pg/g	=
112603-SED-02235-00.3	1746-01-6	2,3,7,8-TCDD	7.06	pg/g	=
112603-SED-02235-00.3	40321-76-4	1,2,3,7,8-PECDD	8.58	pg/g	=
112603-SED-02235-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	3.45	pg/g	=
112603-SED-02235-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	17.8	pg/g	=
112603-SED-02235-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	6.59	pg/g	=
112603-SED-02235-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	258	pg/g	=
112603-SED-02235-00.3	3268-87-9	OCDD	2680	pg/g	=
112603-SED-02235-00.3	51207-31-9	2,3,7,8-TCDF	7330	pg/g	J
112603-SED-02235-00.3	57117-41-6	1,2,3,7,8-PECDF	3180	pg/g	J
112603-SED-02235-00.3	57117-31-4	2,3,4,7,8-PECDF	3350	pg/g	J
112603-SED-02235-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	1660	pg/g	=
112603-SED-02235-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	416	pg/g	=
112603-SED-02235-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	265	pg/g	=
112603-SED-02235-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	348	pg/g	=
112603-SED-02235-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	622	pg/g	=
120103-SED-02237-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	11.5	pg/g	=
120103-SED-02237-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	3.25	pg/g	=
120103-SED-02237-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	3.12	pg/g	=
120103-SED-02237-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	260	pg/g	=
120103-SED-02237-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	3.89	pg/g	=
120103-SED-02237-00.3	39001-02-0	OCDF	177	pg/g	=
120103-SED-02237-00.3	1746-01-6	2,3,7,8-TCDD	0.986	pg/g	=
120103-SED-02237-00.3	40321-76-4	1,2,3,7,8-PECDD	0.707	pg/g	=
120103-SED-02237-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	1.85	pg/g	U
120103-SED-02237-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	3.81	pg/g	=

TABLE C-1

Sample Results for Specific Congeners, Fall 2003 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
120103-SED-02237-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	1.38	pg/g	U
120103-SED-02237-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	61.7	pg/g	=
120103-SED-02237-00.3	3268-87-9	OCDD	424	pg/g	=
120103-SED-02237-00.3	51207-31-9	2,3,7,8-TCDF	58.1	pg/g	=
120103-SED-02237-00.3	57117-41-6	1,2,3,7,8-PECDF	17.9	pg/g	=
120103-SED-02237-00.3	57117-31-4	2,3,4,7,8-PECDF	18.3	pg/g	=
120103-SED-02237-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	12.7	pg/g	=
120203-SED-02239-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	30.3	pg/g	=
120203-SED-02239-00.3	39001-02-0	OCDF	25	pg/g	=
120203-SED-02239-00.3	1746-01-6	2,3,7,8-TCDD	0.96	pg/g	=
120203-SED-02239-00.3	40321-76-4	1,2,3,7,8-PECDD	0.621	pg/g	=
120203-SED-02239-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.654	pg/g	U
120203-SED-02239-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	0.682	pg/g	=
120203-SED-02239-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.607	pg/g	U
120203-SED-02239-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	8.57	pg/g	=
120203-SED-02239-00.3	3268-87-9	OCDD	61.7	pg/g	J
120203-SED-02239-00.3	51207-31-9	2,3,7,8-TCDF	740	pg/g	=
120203-SED-02239-00.3	57117-41-6	1,2,3,7,8-PECDF	967	pg/g	=
120203-SED-02239-00.3	57117-31-4	2,3,4,7,8-PECDF	556	pg/g	=
120203-SED-02239-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	578	pg/g	=
120203-SED-02239-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	129	pg/g	=
120203-SED-02239-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	49.9	pg/g	=
120203-SED-02239-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	97.4	pg/g	=
120203-SED-02239-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	67.1	pg/g	=
120203-SED-02240-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	0.624	pg/g	=
120203-SED-02240-00.3	39001-02-0	OCDF	11.1	pg/g	=
120203-SED-02240-00.3	1746-01-6	2,3,7,8-TCDD	0.782	pg/g	=
120203-SED-02240-00.3	40321-76-4	1,2,3,7,8-PECDD	0.5	pg/g	=
120203-SED-02240-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.638	pg/g	U
120203-SED-02240-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	0.812	pg/g	=
120203-SED-02240-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.636	pg/g	U
120203-SED-02240-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	9.12	pg/g	=
120203-SED-02240-00.3	3268-87-9	OCDD	64.3	pg/g	=
120203-SED-02240-00.3	51207-31-9	2,3,7,8-TCDF	16.4	pg/g	=
120203-SED-02240-00.3	57117-41-6	1,2,3,7,8-PECDF	4.17	pg/g	=
120203-SED-02240-00.3	57117-31-4	2,3,4,7,8-PECDF	4.72	pg/g	=
120203-SED-02240-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	3.1	pg/g	=
120203-SED-02240-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	0.883	pg/g	=
120203-SED-02240-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	0.687	pg/g	U
120203-SED-02240-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	0.654	pg/g	=
120203-SED-02240-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	10.3	pg/g	=
120203-SED-02269-00.3-D	1746-01-6	2,3,7,8-TCDD	0.255	pg/g	U
120203-SED-02269-00.3-D	40321-76-4	1,2,3,7,8-PECDD	0.172	pg/g	=
120203-SED-02269-00.3-D	39227-28-6	1,2,3,4,7,8-HXCDD	0.306	pg/g	U
120203-SED-02269-00.3-D	57653-85-7	1,2,3,6,7,8-HXCDD	0.581	pg/g	=
120203-SED-02269-00.3-D	19408-74-3	1,2,3,7,8,9-HXCDD	0.477	pg/g	=
120203-SED-02269-00.3-D	35822-46-9	1,2,3,4,6,7,8-HPCDD	8.25	pg/g	=
120203-SED-02269-00.3-D	3268-87-9	OCDD	65	pg/g	=
120203-SED-02269-00.3-D	51207-31-9	2,3,7,8-TCDF	1.37	pg/g	=
120203-SED-02269-00.3-D	57117-41-6	1,2,3,7,8-PECDF	1.03	pg/g	=
120203-SED-02269-00.3-D	57117-31-4	2,3,4,7,8-PECDF	1.01	pg/g	=
120203-SED-02269-00.3-D	70648-26-9	1,2,3,4,7,8-HXCDF	0.978	pg/g	=
120203-SED-02269-00.3-D	57117-44-9	1,2,3,6,7,8-HXCDF	0.758	pg/g	=
120203-SED-02269-00.3-D	60851-34-5	2,3,4,6,7,8-HXCDF	0.444	pg/g	=
120203-SED-02269-00.3-D	72918-21-9	1,2,3,7,8,9-HXCDF	0.267	pg/g	U
120203-SED-02269-00.3-D	67562-39-4	1,2,3,4,6,7,8-HPCDF	3.48	pg/g	=
120203-SED-02269-00.3-D	55673-89-7	1,2,3,4,7,8,9-HPCDF	0.257	pg/g	U
120203-SED-02269-00.3-D	39001-02-0	OCDF	6.16	pg/g	=
120303-SED-02241-00.3	1746-01-6	2,3,7,8-TCDD	2.01	pg/g	=
120303-SED-02241-00.3	40321-76-4	1,2,3,7,8-PECDD	3.46	pg/g	=

TABLE C-1

Sample Results for Specific Congeners, Fall 2003 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
120303-SED-02241-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	11.6	pg/g	U
120303-SED-02241-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	40.6	pg/g	=
120303-SED-02241-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	6.55	pg/g	=
120303-SED-02241-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	877	pg/g	=
120303-SED-02241-00.3	3268-87-9	OCDD	7640	pg/g	J
120303-SED-02241-00.3	51207-31-9	2,3,7,8-TCDF	48.6	pg/g	=
120303-SED-02241-00.3	57117-41-6	1,2,3,7,8-PECDF	40.8	pg/g	=
120303-SED-02241-00.3	57117-31-4	2,3,4,7,8-PECDF	31.6	pg/g	=
120303-SED-02241-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	73.7	pg/g	=
120303-SED-02241-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	204	pg/g	=
120303-SED-02241-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	22.2	pg/g	=
120303-SED-02241-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	18.3	pg/g	=
120303-SED-02241-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	4180	pg/g	J
120303-SED-02241-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	43.2	pg/g	=
120303-SED-02241-00.3	39001-02-0	OCDF	2900	pg/g	=
120303-SED-02242-00.3	1746-01-6	2,3,7,8-TCDD	2.2	pg/g	=
120303-SED-02242-00.3	40321-76-4	1,2,3,7,8-PECDD	2.1	pg/g	=
120303-SED-02242-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	6.05	pg/g	=
120303-SED-02242-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	24	pg/g	=
120303-SED-02242-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	18.1	pg/g	=
120303-SED-02242-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	114	pg/g	=
120303-SED-02242-00.3	3268-87-9	OCDD	258	pg/g	=
120303-SED-02242-00.3	51207-31-9	2,3,7,8-TCDF	87.3	pg/g	=
120303-SED-02242-00.3	57117-41-6	1,2,3,7,8-PECDF	28.7	pg/g	=
120303-SED-02242-00.3	57117-31-4	2,3,4,7,8-PECDF	33.3	pg/g	=
120303-SED-02242-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	34.7	pg/g	=
120303-SED-02242-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	11.4	pg/g	=
120303-SED-02242-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	8.38	pg/g	=
120303-SED-02242-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	9.36	pg/g	=
120303-SED-02242-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	73.8	pg/g	=
120303-SED-02242-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	13.4	pg/g	=
120303-SED-02242-00.3	39001-02-0	OCDF	82.5	pg/g	=
120403-SED-02243-00.3	1746-01-6	2,3,7,8-TCDD	0.729	pg/g	=
120403-SED-02243-00.3	40321-76-4	1,2,3,7,8-PECDD	0.435	pg/g	=
120403-SED-02243-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.368	pg/g	U
120403-SED-02243-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	0.886	pg/g	=
120403-SED-02243-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.361	pg/g	U
120403-SED-02243-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	11.1	pg/g	=
120403-SED-02243-00.3	3268-87-9	OCDD	106	pg/g	=
120403-SED-02243-00.3	51207-31-9	2,3,7,8-TCDF	26.3	pg/g	=
120403-SED-02243-00.3	57117-41-6	1,2,3,7,8-PECDF	6.66	pg/g	=
120403-SED-02243-00.3	57117-31-4	2,3,4,7,8-PECDF	7.62	pg/g	=
120403-SED-02243-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	3.85	pg/g	=
120403-SED-02243-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	1.18	pg/g	=
120403-SED-02243-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	0.916	pg/g	=
120403-SED-02243-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	0.688	pg/g	=
120403-SED-02243-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	13.1	pg/g	=
120403-SED-02243-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	0.716	pg/g	=
120403-SED-02243-00.3	39001-02-0	OCDF	23.5	pg/g	=
120403-SED-02244-00.3	1746-01-6	2,3,7,8-TCDD	2.57	pg/g	=
120403-SED-02244-00.3	40321-76-4	1,2,3,7,8-PECDD	1.18	pg/g	=
120403-SED-02244-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.676	pg/g	U
120403-SED-02244-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.82	pg/g	=
120403-SED-02244-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.685	pg/g	U
120403-SED-02244-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	17.1	pg/g	=
120403-SED-02244-00.3	3268-87-9	OCDD	115	pg/g	J
120403-SED-02244-00.3	51207-31-9	2,3,7,8-TCDF	754	pg/g	=
120403-SED-02244-00.3	57117-41-6	1,2,3,7,8-PECDF	299	pg/g	=
120403-SED-02244-00.3	57117-31-4	2,3,4,7,8-PECDF	289	pg/g	=
120403-SED-02244-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	166	pg/g	=

TABLE C-1

Sample Results for Specific Congeners, Fall 2003 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
120403-SED-02244-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	34.2	pg/g	=
120403-SED-02244-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	20.2	pg/g	=
120403-SED-02244-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	37.3	pg/g	=
120403-SED-02244-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	39.6	pg/g	=
120403-SED-02244-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	8.82	pg/g	=
120403-SED-02244-00.3	39001-02-0	OCDF	38.6	pg/g	=
120503-SED-02246-00.3	1746-01-6	2,3,7,8-TCDD	0.748	pg/g	=
120503-SED-02246-00.3	40321-76-4	1,2,3,7,8-PECDD	0.583	pg/g	=
120503-SED-02246-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.303	pg/g	=
120503-SED-02246-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.59	pg/g	=
120503-SED-02246-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.588	pg/g	U
120503-SED-02246-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	28	pg/g	=
120503-SED-02246-00.3	3268-87-9	OCDD	362	pg/g	=
120503-SED-02246-00.3	51207-31-9	2,3,7,8-TCDF	478	pg/g	=
120503-SED-02246-00.3	57117-41-6	1,2,3,7,8-PECDF	133	pg/g	=
120503-SED-02246-00.3	57117-31-4	2,3,4,7,8-PECDF	158	pg/g	=
120503-SED-02246-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	52.8	pg/g	=
120503-SED-02246-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	12.3	pg/g	=
120503-SED-02246-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	8.19	pg/g	=
120503-SED-02246-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	9.84	pg/g	=
120503-SED-02246-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	25.1	pg/g	=
120503-SED-02246-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	4.08	pg/g	=
120503-SED-02246-00.3	39001-02-0	OCDF	55.5	pg/g	=
120803-SED-02247-00.3	1746-01-6	2,3,7,8-TCDD	2.26	pg/g	=
120803-SED-02247-00.3	40321-76-4	1,2,3,7,8-PECDD	2.55	pg/g	=
120803-SED-02247-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	1.48	pg/g	=
120803-SED-02247-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	6.18	pg/g	=
120803-SED-02247-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	2.45	pg/g	=
120803-SED-02247-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	51.3	pg/g	=
120803-SED-02247-00.3	3268-87-9	OCDD	338	pg/g	J
120803-SED-02247-00.3	51207-31-9	2,3,7,8-TCDF	869	pg/g	=
120803-SED-02247-00.3	57117-41-6	1,2,3,7,8-PECDF	721	pg/g	=
120803-SED-02247-00.3	57117-31-4	2,3,4,7,8-PECDF	567	pg/g	=
120803-SED-02247-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	464	pg/g	=
120803-SED-02247-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	116	pg/g	=
120803-SED-02247-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	58.5	pg/g	=
120803-SED-02247-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	112	pg/g	=
120803-SED-02247-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	106	pg/g	=
120803-SED-02247-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	31.9	pg/g	=
120803-SED-02247-00.3	39001-02-0	OCDF	103	pg/g	=
120803-SED-02248-00.3	1746-01-6	2,3,7,8-TCDD	0.973	pg/g	=
120803-SED-02248-00.3	40321-76-4	1,2,3,7,8-PECDD	0.502	pg/g	=
120803-SED-02248-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.735	pg/g	U
120803-SED-02248-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.25	pg/g	=
120803-SED-02248-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.667	pg/g	U
120803-SED-02248-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	17.1	pg/g	=
120803-SED-02248-00.3	3268-87-9	OCDD	146	pg/g	=
120803-SED-02248-00.3	51207-31-9	2,3,7,8-TCDF	24.7	pg/g	=
120803-SED-02248-00.3	57117-41-6	1,2,3,7,8-PECDF	8.57	pg/g	=
120803-SED-02248-00.3	57117-31-4	2,3,4,7,8-PECDF	8.37	pg/g	=
120803-SED-02248-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	7.45	pg/g	=
120803-SED-02248-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	4.79	pg/g	=
120803-SED-02248-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.34	pg/g	=
120803-SED-02248-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	1.16	pg/g	U
120803-SED-02248-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	26.1	pg/g	=
120803-SED-02248-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.61	pg/g	=
120803-SED-02248-00.3	39001-02-0	OCDF	32.6	pg/g	=
120903-SED-02249-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	3.06	pg/g	=
120903-SED-02249-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.57	pg/g	=
120903-SED-02249-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	1.62	pg/g	=

TABLE C-1

Sample Results for Specific Congeners, Fall 2003 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
120903-SED-02249-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	18.8	pg/g	=
120903-SED-02249-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	2.09	pg/g	=
120903-SED-02249-00.3	39001-02-0	OCDF	27	pg/g	=
120903-SED-02249-00.3	1746-01-6	2,3,7,8-TCDD	0.757	pg/g	U
120903-SED-02249-00.3	40321-76-4	1,2,3,7,8-PECDD	0.679	pg/g	=
120903-SED-02249-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.477	pg/g	=
120903-SED-02249-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.55	pg/g	=
120903-SED-02249-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.635	pg/g	=
120903-SED-02249-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	15	pg/g	=
120903-SED-02249-00.3	3268-87-9	OCDD	117	pg/g	=
120903-SED-02249-00.3	51207-31-9	2,3,7,8-TCDF	26.4	pg/g	=
120903-SED-02249-00.3	57117-41-6	1,2,3,7,8-PECDF	9.82	pg/g	=
120903-SED-02249-00.3	57117-31-4	2,3,4,7,8-PECDF	9.83	pg/g	=
120903-SED-02249-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	9.99	pg/g	=
120903-SED-02252-00.3	1746-01-6	2,3,7,8-TCDD	0.442	pg/g	=
120903-SED-02252-00.3	40321-76-4	1,2,3,7,8-PECDD	0.505	pg/g	U
120903-SED-02252-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.893	pg/g	U
120903-SED-02252-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.49	pg/g	=
120903-SED-02252-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.727	pg/g	U
120903-SED-02252-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	33.1	pg/g	=
120903-SED-02252-00.3	3268-87-9	OCDD	330	pg/g	=
120903-SED-02252-00.3	51207-31-9	2,3,7,8-TCDF	8.56	pg/g	=
120903-SED-02252-00.3	57117-41-6	1,2,3,7,8-PECDF	3.78	pg/g	=
120903-SED-02252-00.3	57117-31-4	2,3,4,7,8-PECDF	3.23	pg/g	=
120903-SED-02252-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	5.1	pg/g	=
120903-SED-02252-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	6.34	pg/g	=
120903-SED-02252-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.15	pg/g	=
120903-SED-02252-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	0.894	pg/g	=
120903-SED-02252-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	31	pg/g	=
120903-SED-02252-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.86	pg/g	=
120903-SED-02252-00.3	39001-02-0	OCDF	96.9	pg/g	=
120903-SED-02270-00.3-D	1746-01-6	2,3,7,8-TCDD	0.718	pg/g	U
120903-SED-02270-00.3-D	40321-76-4	1,2,3,7,8-PECDD	0.46	pg/g	=
120903-SED-02270-00.3-D	39227-28-6	1,2,3,4,7,8-HXCDD	0.708	pg/g	U
120903-SED-02270-00.3-D	57653-85-7	1,2,3,6,7,8-HXCDD	0.98	pg/g	=
120903-SED-02270-00.3-D	19408-74-3	1,2,3,7,8,9-HXCDD	0.595	pg/g	U
120903-SED-02270-00.3-D	35822-46-9	1,2,3,4,6,7,8-HPCDD	9.98	pg/g	=
120903-SED-02270-00.3-D	3268-87-9	OCDD	115	pg/g	=
120903-SED-02270-00.3-D	51207-31-9	2,3,7,8-TCDF	17.7	pg/g	=
120903-SED-02270-00.3-D	57117-41-6	1,2,3,7,8-PECDF	4.64	pg/g	=
120903-SED-02270-00.3-D	57117-31-4	2,3,4,7,8-PECDF	5.95	pg/g	=
120903-SED-02270-00.3-D	70648-26-9	1,2,3,4,7,8-HXCDF	4.11	pg/g	=
120903-SED-02270-00.3-D	57117-44-9	1,2,3,6,7,8-HXCDF	2.21	pg/g	=
120903-SED-02270-00.3-D	60851-34-5	2,3,4,6,7,8-HXCDF	1.02	pg/g	=
120903-SED-02270-00.3-D	72918-21-9	1,2,3,7,8,9-HXCDF	0.861	pg/g	=
120903-SED-02270-00.3-D	67562-39-4	1,2,3,4,6,7,8-HPCDF	16.4	pg/g	=
120903-SED-02270-00.3-D	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.33	pg/g	=
120903-SED-02270-00.3-D	39001-02-0	OCDF	19.9	pg/g	=
121103-SED-02254-00.3	1746-01-6	2,3,7,8-TCDD	0.309	pg/g	U
121103-SED-02254-00.3	40321-76-4	1,2,3,7,8-PECDD	0.284	pg/g	U
121103-SED-02254-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.399	pg/g	U
121103-SED-02254-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	0.783	pg/g	=
121103-SED-02254-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.522	pg/g	=
121103-SED-02254-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	12.5	pg/g	=
121103-SED-02254-00.3	3268-87-9	OCDD	97.2	pg/g	=
121103-SED-02254-00.3	51207-31-9	2,3,7,8-TCDF	4.65	pg/g	=
121103-SED-02254-00.3	57117-41-6	1,2,3,7,8-PECDF	2.95	pg/g	=
121103-SED-02254-00.3	57117-31-4	2,3,4,7,8-PECDF	2.61	pg/g	=
121103-SED-02254-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	2.04	pg/g	=
121103-SED-02254-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	0.745	pg/g	=

TABLE C-1

Sample Results for Specific Congeners, Fall 2003 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
121103-SED-02254-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	0.508	pg/g	U
121103-SED-02254-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	0.366	pg/g	U
121103-SED-02254-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	5.08	pg/g	=
121103-SED-02254-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	0.382	pg/g	U
121103-SED-02254-00.3	39001-02-0	OCDF	8.47	pg/g	=
121103-SED-02271-00.3-D	1746-01-6	2,3,7,8-TCDD	3.87	pg/g	=
121103-SED-02271-00.3-D	40321-76-4	1,2,3,7,8-PECDD	3.91	pg/g	=
121103-SED-02271-00.3-D	39227-28-6	1,2,3,4,7,8-HXCDD	2.95	pg/g	=
121103-SED-02271-00.3-D	57653-85-7	1,2,3,6,7,8-HXCDD	15.7	pg/g	=
121103-SED-02271-00.3-D	19408-74-3	1,2,3,7,8,9-HXCDD	5.75	pg/g	=
121103-SED-02271-00.3-D	35822-46-9	1,2,3,4,6,7,8-HPCDD	318	pg/g	=
121103-SED-02271-00.3-D	3268-87-9	OCDD	3790	pg/g	J
121103-SED-02271-00.3-D	51207-31-9	2,3,7,8-TCDF	758	pg/g	=
121103-SED-02271-00.3-D	57117-41-6	1,2,3,7,8-PECDF	501	pg/g	=
121103-SED-02271-00.3-D	57117-31-4	2,3,4,7,8-PECDF	430	pg/g	=
121103-SED-02271-00.3-D	70648-26-9	1,2,3,4,7,8-HXCDF	328	pg/g	=
121103-SED-02271-00.3-D	57117-44-9	1,2,3,6,7,8-HXCDF	71.2	pg/g	=
121103-SED-02271-00.3-D	60851-34-5	2,3,4,6,7,8-HXCDF	42.2	pg/g	=
121103-SED-02271-00.3-D	72918-21-9	1,2,3,7,8,9-HXCDF	64.3	pg/g	=
121103-SED-02271-00.3-D	67562-39-4	1,2,3,4,6,7,8-HPCDF	543	pg/g	=
121103-SED-02271-00.3-D	55673-89-7	1,2,3,4,7,8,9-HPCDF	42.7	pg/g	=
121103-SED-02271-00.3-D	39001-02-0	OCDF	1160	pg/g	=

TABLE C-2

Sample Results for Specific Congeners, Summer 2004 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
070104-SED-02776-00.3	1746-01-6	2,3,7,8-TCDD	0.964	pg/g	=
070104-SED-02776-00.3	40321-76-4	1,2,3,7,8-PECDD	0.49	pg/g	U
070104-SED-02776-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.252	pg/g	J
070104-SED-02776-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.14	pg/g	J
070104-SED-02776-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.384	pg/g	J
070104-SED-02776-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	10.9	pg/g	=
070104-SED-02776-00.3	3268-87-9	OCDD	90.7	pg/g	=
070104-SED-02776-00.3	51207-31-9	2,3,7,8-TCDF	65.5	pg/g	=
070104-SED-02776-00.3	57117-41-6	1,2,3,7,8-PECDF	26	pg/g	=
070104-SED-02776-00.3	57117-31-4	2,3,4,7,8-PECDF	24.3	pg/g	=
070104-SED-02776-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	16.3	pg/g	=
070104-SED-02776-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	3.7	pg/g	=
070104-SED-02776-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	2.45	pg/g	J
070104-SED-02776-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	3.22	pg/g	=
070104-SED-02776-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	20.6	pg/g	=
070104-SED-02776-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.68	pg/g	J
070104-SED-02776-00.3	39001-02-0	OCDF	22.8	pg/g	=
070104-SED-02776-00.3	41903-57-5	TOTAL TCDD	11	pg/g	=
070104-SED-02776-00.3	36088-22-9	TOTAL PECDD	5.6	pg/g	=
070104-SED-02776-00.3	34465-46-8	TOTAL HXCDD	12.7	pg/g	=
070104-SED-02776-00.3	37871-00-4	TOTAL HPCDD	20.7	pg/g	=
070104-SED-02776-00.3	55722-27-5	TOTAL TCDF	205	pg/g	=
070104-SED-02776-00.3	30402-15-4	TOTAL PECDF	104	pg/g	=
070104-SED-02776-00.3	55684-94-1	TOTAL HXCDF	42.6	pg/g	=
070104-SED-02776-00.3	38998-75-3	TOTAL HPCDF	45.6	pg/g	=
070104-SED-02777-00.3	1746-01-6	2,3,7,8-TCDD	1.02	pg/g	=
070104-SED-02777-00.3	40321-76-4	1,2,3,7,8-PECDD	0.552	pg/g	J
070104-SED-02777-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.268	pg/g	J
070104-SED-02777-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.06	pg/g	J
070104-SED-02777-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.493	pg/g	J
070104-SED-02777-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	9.86	pg/g	=
070104-SED-02777-00.3	3268-87-9	OCDD	80.1	pg/g	=
070104-SED-02777-00.3	51207-31-9	2,3,7,8-TCDF	80.7	pg/g	=
070104-SED-02777-00.3	57117-41-6	1,2,3,7,8-PECDF	23.9	pg/g	=
070104-SED-02777-00.3	57117-31-4	2,3,4,7,8-PECDF	25.5	pg/g	=
070104-SED-02777-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	12.5	pg/g	=
070104-SED-02777-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	3.14	pg/g	=
070104-SED-02777-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	2.16	pg/g	J
070104-SED-02777-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	2.47	pg/g	J
070104-SED-02777-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	14.9	pg/g	=
070104-SED-02777-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.34	pg/g	J
070104-SED-02777-00.3	39001-02-0	OCDF	17.4	pg/g	=
070104-SED-02777-00.3	41903-57-5	TOTAL TCDD	10.3	pg/g	=
070104-SED-02777-00.3	36088-22-9	TOTAL PECDD	5.92	pg/g	=
070104-SED-02777-00.3	34465-46-8	TOTAL HXCDD	11.1	pg/g	=
070104-SED-02777-00.3	37871-00-4	TOTAL HPCDD	19.5	pg/g	=
070104-SED-02777-00.3	55722-27-5	TOTAL TCDF	226	pg/g	=
070104-SED-02777-00.3	30402-15-4	TOTAL PECDF	103	pg/g	=
070104-SED-02777-00.3	55684-94-1	TOTAL HXCDF	35.1	pg/g	=
070104-SED-02777-00.3	38998-75-3	TOTAL HPCDF	35.1	pg/g	=
070104-SED-02779-00.3	1746-01-6	2,3,7,8-TCDD	0.907	pg/g	=
070104-SED-02779-00.3	40321-76-4	1,2,3,7,8-PECDD	0.569	pg/g	J
070104-SED-02779-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.249	pg/g	J
070104-SED-02779-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.22	pg/g	J
070104-SED-02779-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.182	pg/g	U
070104-SED-02779-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	20.8	pg/g	=

TABLE C-2

Sample Results for Specific Congeners, Summer 2004 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
070104-SED-02779-00.3	3268-87-9	OCDD	265	pg/g	=
070104-SED-02779-00.3	51207-31-9	2,3,7,8-TCDF	27.4	pg/g	=
070104-SED-02779-00.3	57117-41-6	1,2,3,7,8-PECDF	7.58	pg/g	=
070104-SED-02779-00.3	57117-31-4	2,3,4,7,8-PECDF	8.19	pg/g	=
070104-SED-02779-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	5.53	pg/g	=
070104-SED-02779-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	1.6	pg/g	J
070104-SED-02779-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.21	pg/g	J
070104-SED-02779-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	1.02	pg/g	J
070104-SED-02779-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	18.8	pg/g	=
070104-SED-02779-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.16	pg/g	J
070104-SED-02779-00.3	39001-02-0	OCDF	49	pg/g	=
070104-SED-02779-00.3	41903-57-5	TOTAL TCDD	9.48	pg/g	=
070104-SED-02779-00.3	36088-22-9	TOTAL PECDD	5.82	pg/g	=
070104-SED-02779-00.3	34465-46-8	TOTAL HXCDD	8.86	pg/g	=
070104-SED-02779-00.3	37871-00-4	TOTAL HPCDD	36.5	pg/g	=
070104-SED-02779-00.3	55722-27-5	TOTAL TCDF	99.9	pg/g	=
070104-SED-02779-00.3	30402-15-4	TOTAL PECDF	42.1	pg/g	=
070104-SED-02779-00.3	55684-94-1	TOTAL HXCDF	25.3	pg/g	=
070104-SED-02779-00.3	38998-75-3	TOTAL HPCDF	53.1	pg/g	=
070104-SED-02782-00.3	1746-01-6	2,3,7,8-TCDD	3.49	pg/g	=
070104-SED-02782-00.3	40321-76-4	1,2,3,7,8-PECDD	2.62	pg/g	=
070104-SED-02782-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	1.24	pg/g	J
070104-SED-02782-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	7.38	pg/g	=
070104-SED-02782-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	2.29	pg/g	J
070104-SED-02782-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	58.1	pg/g	=
070104-SED-02782-00.3	3268-87-9	OCDD	395	pg/g	=
070104-SED-02782-00.3	51207-31-9	2,3,7,8-TCDF	229	pg/g	=
070104-SED-02782-00.3	57117-41-6	1,2,3,7,8-PECDF	51.7	pg/g	=
070104-SED-02782-00.3	57117-31-4	2,3,4,7,8-PECDF	60.8	pg/g	=
070104-SED-02782-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	34.3	pg/g	=
070104-SED-02782-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	8.99	pg/g	=
070104-SED-02782-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	7.6	pg/g	=
070104-SED-02782-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	6.54	pg/g	=
070104-SED-02782-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	123	pg/g	=
070104-SED-02782-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	6.18	pg/g	=
070104-SED-02782-00.3	39001-02-0	OCDF	95.2	pg/g	=
070104-SED-02782-00.3	41903-57-5	TOTAL TCDD	71.5	pg/g	=
070104-SED-02782-00.3	36088-22-9	TOTAL PECDD	38.2	pg/g	=
070104-SED-02782-00.3	34465-46-8	TOTAL HXCDD	74.1	pg/g	=
070104-SED-02782-00.3	37871-00-4	TOTAL HPCDD	116	pg/g	=
070104-SED-02782-00.3	55722-27-5	TOTAL TCDF	1100	pg/g	=
070104-SED-02782-00.3	30402-15-4	TOTAL PECDF	310	pg/g	=
070104-SED-02782-00.3	55684-94-1	TOTAL HXCDF	188	pg/g	=
070104-SED-02782-00.3	38998-75-3	TOTAL HPCDF	258	pg/g	=
070204-SED-02775-00.3	1746-01-6	2,3,7,8-TCDD	1.45	pg/g	=
070204-SED-02775-00.3	40321-76-4	1,2,3,7,8-PECDD	0.803	pg/g	J
070204-SED-02775-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.334	pg/g	J
070204-SED-02775-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	2.21	pg/g	J
070204-SED-02775-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.765	pg/g	J
070204-SED-02775-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	20.1	pg/g	=
070204-SED-02775-00.3	3268-87-9	OCDD	132	pg/g	=
070204-SED-02775-00.3	51207-31-9	2,3,7,8-TCDF	63.4	pg/g	=
070204-SED-02775-00.3	57117-41-6	1,2,3,7,8-PECDF	39.4	pg/g	=
070204-SED-02775-00.3	57117-31-4	2,3,4,7,8-PECDF	36.5	pg/g	=
070204-SED-02775-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	31.5	pg/g	=
070204-SED-02775-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	6.49	pg/g	=

TABLE C-2

Sample Results for Specific Congeners, Summer 2004 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
070204-SED-02775-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	4.03	pg/g	=
070204-SED-02775-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	5.81	pg/g	=
070204-SED-02775-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	30.3	pg/g	=
070204-SED-02775-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	3.22	pg/g	=
070204-SED-02775-00.3	39001-02-0	OCDF	42.3	pg/g	=
070204-SED-02775-00.3	41903-57-5	TOTAL TCDD	15.9	pg/g	=
070204-SED-02775-00.3	36088-22-9	TOTAL PECDD	9.48	pg/g	=
070204-SED-02775-00.3	34465-46-8	TOTAL HXCDD	19.1	pg/g	=
070204-SED-02775-00.3	37871-00-4	TOTAL HPCDD	37.2	pg/g	=
070204-SED-02775-00.3	55722-27-5	TOTAL TCDF	202	pg/g	=
070204-SED-02775-00.3	30402-15-4	TOTAL PECDF	150	pg/g	=
070204-SED-02775-00.3	55684-94-1	TOTAL HXCDF	75.9	pg/g	=
070204-SED-02775-00.3	38998-75-3	TOTAL HPCDF	72.9	pg/g	=
070704-SED-02793-00.3	1746-01-6	2,3,7,8-TCDD	1.12	pg/g	=
070704-SED-02793-00.3	40321-76-4	1,2,3,7,8-PECDD	0.602	pg/g	J
070704-SED-02793-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.243	pg/g	J
070704-SED-02793-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.18	pg/g	J
070704-SED-02793-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.385	pg/g	J
070704-SED-02793-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	13.5	pg/g	=
070704-SED-02793-00.3	3268-87-9	OCDD	138	pg/g	=
070704-SED-02793-00.3	51207-31-9	2,3,7,8-TCDF	50.7	pg/g	=
070704-SED-02793-00.3	57117-41-6	1,2,3,7,8-PECDF	9.6	pg/g	=
070704-SED-02793-00.3	57117-31-4	2,3,4,7,8-PECDF	12.8	pg/g	=
070704-SED-02793-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	5.69	pg/g	=
070704-SED-02793-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	1.45	pg/g	J
070704-SED-02793-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.25	pg/g	J
070704-SED-02793-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	0.966	pg/g	J
070704-SED-02793-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	20.5	pg/g	=
070704-SED-02793-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	1.04	pg/g	J
070704-SED-02793-00.3	39001-02-0	OCDF	36	pg/g	=
070704-SED-02793-00.3	41903-57-5	TOTAL TCDD	12.2	pg/g	=
070704-SED-02793-00.3	36088-22-9	TOTAL PECDD	3.83	pg/g	=
070704-SED-02793-00.3	34465-46-8	TOTAL HXCDD	10.3	pg/g	=
070704-SED-02793-00.3	37871-00-4	TOTAL HPCDD	25.1	pg/g	=
070704-SED-02793-00.3	55722-27-5	TOTAL TCDF	168	pg/g	=
070704-SED-02793-00.3	30402-15-4	TOTAL PECDF	54.9	pg/g	=
070704-SED-02793-00.3	55684-94-1	TOTAL HXCDF	23.1	pg/g	=
070704-SED-02793-00.3	38998-75-3	TOTAL HPCDF	46.2	pg/g	=
070704-SED-02794-00.3	1746-01-6	2,3,7,8-TCDD	4.86	pg/g	=
070704-SED-02794-00.3	40321-76-4	1,2,3,7,8-PECDD	2.69	pg/g	=
070704-SED-02794-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	1.26	pg/g	J
070704-SED-02794-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	7.1	pg/g	=
070704-SED-02794-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	2.03	pg/g	J
070704-SED-02794-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	65.4	pg/g	=
070704-SED-02794-00.3	3268-87-9	OCDD	586	pg/g	=
070704-SED-02794-00.3	51207-31-9	2,3,7,8-TCDF	1200	pg/g	J
070704-SED-02794-00.3	57117-41-6	1,2,3,7,8-PECDF	579	pg/g	=
070704-SED-02794-00.3	57117-31-4	2,3,4,7,8-PECDF	572	pg/g	=
070704-SED-02794-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	415	pg/g	=
070704-SED-02794-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	106	pg/g	=
070704-SED-02794-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	74	pg/g	=
070704-SED-02794-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	101	pg/g	=
070704-SED-02794-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	271	pg/g	=
070704-SED-02794-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	29.7	pg/g	=
070704-SED-02794-00.3	39001-02-0	OCDF	245	pg/g	=
070704-SED-02794-00.3	41903-57-5	TOTAL TCDD	55.5	pg/g	=

TABLE C-2

Sample Results for Specific Congeners, Summer 2004 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
070704-SED-02794-00.3	36088-22-9	TOTAL PECDD	35	pg/g	=
070704-SED-02794-00.3	34465-46-8	TOTAL HXCDD	51.4	pg/g	=
070704-SED-02794-00.3	37871-00-4	TOTAL HPCDD	116	pg/g	=
070704-SED-02794-00.3	55722-27-5	TOTAL TCDF	3340	pg/g	J
070704-SED-02794-00.3	30402-15-4	TOTAL PECDF	2500	pg/g	=
070704-SED-02794-00.3	55684-94-1	TOTAL HXCDF	960	pg/g	=
070704-SED-02794-00.3	38998-75-3	TOTAL HPCDF	508	pg/g	=
070704-SED-02795-00.3	1746-01-6	2,3,7,8-TCDD	1.1	pg/g	=
070704-SED-02795-00.3	40321-76-4	1,2,3,7,8-PECDD	0.688	pg/g	J
070704-SED-02795-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.221	pg/g	U
070704-SED-02795-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.59	pg/g	J
070704-SED-02795-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.465	pg/g	J
070704-SED-02795-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	16.5	pg/g	=
070704-SED-02795-00.3	3268-87-9	OCDD	126	pg/g	=
070704-SED-02795-00.3	51207-31-9	2,3,7,8-TCDF	1740	pg/g	J
070704-SED-02795-00.3	57117-41-6	1,2,3,7,8-PECDF	436	pg/g	=
070704-SED-02795-00.3	57117-31-4	2,3,4,7,8-PECDF	509	pg/g	=
070704-SED-02795-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	211	pg/g	=
070704-SED-02795-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	41.5	pg/g	=
070704-SED-02795-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	29.3	pg/g	=
070704-SED-02795-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	36.8	pg/g	=
070704-SED-02795-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	52.5	pg/g	=
070704-SED-02795-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	8.51	pg/g	=
070704-SED-02795-00.3	39001-02-0	OCDF	46.7	pg/g	=
070704-SED-02795-00.3	41903-57-5	TOTAL TCDD	11	pg/g	=
070704-SED-02795-00.3	36088-22-9	TOTAL PECDD	6.17	pg/g	=
070704-SED-02795-00.3	34465-46-8	TOTAL HXCDD	11.5	pg/g	=
070704-SED-02795-00.3	37871-00-4	TOTAL HPCDD	31.6	pg/g	=
070704-SED-02795-00.3	55722-27-5	TOTAL TCDF	3800	pg/g	J
070704-SED-02795-00.3	30402-15-4	TOTAL PECDF	1670	pg/g	=
070704-SED-02795-00.3	55684-94-1	TOTAL HXCDF	382	pg/g	=
070704-SED-02795-00.3	38998-75-3	TOTAL HPCDF	107	pg/g	=
070704-SED-02804-00.3	1746-01-6	2,3,7,8-TCDD	1.29	pg/g	=
070704-SED-02804-00.3	40321-76-4	1,2,3,7,8-PECDD	0.708	pg/g	J
070704-SED-02804-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.254	pg/g	U
070704-SED-02804-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.36	pg/g	J
070704-SED-02804-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.471	pg/g	U
070704-SED-02804-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	14	pg/g	=
070704-SED-02804-00.3	3268-87-9	OCDD	137	pg/g	=
070704-SED-02804-00.3	51207-31-9	2,3,7,8-TCDF	67.4	pg/g	=
070704-SED-02804-00.3	57117-41-6	1,2,3,7,8-PECDF	19.1	pg/g	=
070704-SED-02804-00.3	57117-31-4	2,3,4,7,8-PECDF	18.1	pg/g	=
070704-SED-02804-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	13.1	pg/g	=
070704-SED-02804-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	2.96	pg/g	=
070704-SED-02804-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	1.91	pg/g	J
070704-SED-02804-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	1.94	pg/g	J
070704-SED-02804-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	22.6	pg/g	=
070704-SED-02804-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	2.01	pg/g	J
070704-SED-02804-00.3	39001-02-0	OCDF	30.2	pg/g	=
070704-SED-02804-00.3	41903-57-5	TOTAL TCDD	14.1	pg/g	=
070704-SED-02804-00.3	36088-22-9	TOTAL PECDD	7.83	pg/g	=
070704-SED-02804-00.3	34465-46-8	TOTAL HXCDD	11.6	pg/g	=
070704-SED-02804-00.3	37871-00-4	TOTAL HPCDD	27.2	pg/g	=
070704-SED-02804-00.3	55722-27-5	TOTAL TCDF	210	pg/g	=
070704-SED-02804-00.3	30402-15-4	TOTAL PECDF	82.3	pg/g	=
070704-SED-02804-00.3	55684-94-1	TOTAL HXCDF	38.7	pg/g	=

TABLE C-2

Sample Results for Specific Congeners, Summer 2004 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
070704-SED-02804-00.3	38998-75-3	TOTAL HPCDF	51.6	pg/g	=
070804-SED-02792-00.3	1746-01-6	2,3,7,8-TCDD	4.09	pg/g	=
070804-SED-02792-00.3	40321-76-4	1,2,3,7,8-PECDD	13.8	pg/g	=
070804-SED-02792-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	12.1	pg/g	=
070804-SED-02792-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	49.9	pg/g	=
070804-SED-02792-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	25.2	pg/g	=
070804-SED-02792-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	214	pg/g	=
070804-SED-02792-00.3	3268-87-9	OCDD	1080	pg/g	=
070804-SED-02792-00.3	51207-31-9	2,3,7,8-TCDF	234	pg/g	=
070804-SED-02792-00.3	57117-41-6	1,2,3,7,8-PECDF	71.7	pg/g	=
070804-SED-02792-00.3	57117-31-4	2,3,4,7,8-PECDF	72.6	pg/g	=
070804-SED-02792-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	72	pg/g	=
070804-SED-02792-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	24.5	pg/g	=
070804-SED-02792-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	20.2	pg/g	=
070804-SED-02792-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	37.4	pg/g	=
070804-SED-02792-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	122	pg/g	=
070804-SED-02792-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	39.8	pg/g	=
070804-SED-02792-00.3	39001-02-0	OCDF	213	pg/g	=
070804-SED-02792-00.3	41903-57-5	TOTAL TCDD	88.3	pg/g	=
070804-SED-02792-00.3	36088-22-9	TOTAL PECDD	155	pg/g	=
070804-SED-02792-00.3	34465-46-8	TOTAL HXCDD	447	pg/g	=
070804-SED-02792-00.3	37871-00-4	TOTAL HPCDD	403	pg/g	=
070804-SED-02792-00.3	55722-27-5	TOTAL TCDF	685	pg/g	=
070804-SED-02792-00.3	30402-15-4	TOTAL PECDF	356	pg/g	=
070804-SED-02792-00.3	55684-94-1	TOTAL HXCDF	290	pg/g	=
070804-SED-02792-00.3	38998-75-3	TOTAL HPCDF	380	pg/g	=
070904-SED-02816-00.3	1746-01-6	2,3,7,8-TCDD	1.21	pg/g	=
070904-SED-02816-00.3	40321-76-4	1,2,3,7,8-PECDD	0.633	pg/g	J
070904-SED-02816-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.539	pg/g	U
070904-SED-02816-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	1.4	pg/g	J
070904-SED-02816-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.896	pg/g	U
070904-SED-02816-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	11.2	pg/g	=
070904-SED-02816-00.3	3268-87-9	OCDD	76.5	pg/g	=
070904-SED-02816-00.3	51207-31-9	2,3,7,8-TCDF	86.9	pg/g	=
070904-SED-02816-00.3	57117-41-6	1,2,3,7,8-PECDF	60.5	pg/g	=
070904-SED-02816-00.3	57117-31-4	2,3,4,7,8-PECDF	41	pg/g	=
070904-SED-02816-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	33.3	pg/g	=
070904-SED-02816-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	7.58	pg/g	=
070904-SED-02816-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	3.99	pg/g	=
070904-SED-02816-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	5.82	pg/g	=
070904-SED-02816-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	18.6	pg/g	=
070904-SED-02816-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	2.27	pg/g	J
070904-SED-02816-00.3	39001-02-0	OCDF	17.2	pg/g	=
070904-SED-02816-00.3	41903-57-5	TOTAL TCDD	12.4	pg/g	=
070904-SED-02816-00.3	36088-22-9	TOTAL PECDD	7.34	pg/g	=
070904-SED-02816-00.3	34465-46-8	TOTAL HXCDD	11.8	pg/g	=
070904-SED-02816-00.3	37871-00-4	TOTAL HPCDD	21.2	pg/g	=
070904-SED-02816-00.3	55722-27-5	TOTAL TCDF	233	pg/g	=
070904-SED-02816-00.3	30402-15-4	TOTAL PECDF	175	pg/g	=
070904-SED-02816-00.3	55684-94-1	TOTAL HXCDF	69.2	pg/g	=
070904-SED-02816-00.3	38998-75-3	TOTAL HPCDF	46.4	pg/g	=
070904-SED-02817-00.3	1746-01-6	2,3,7,8-TCDD	0.92	pg/g	=
070904-SED-02817-00.3	40321-76-4	1,2,3,7,8-PECDD	0.569	pg/g	J
070904-SED-02817-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.504	pg/g	J
070904-SED-02817-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	27.6	pg/g	=
070904-SED-02817-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	1.53	pg/g	J

TABLE C-2

Sample Results for Specific Congeners, Summer 2004 Sediment Sampling Event

Dow MOCA Sediment Variability Evaluation

Sample ID	CAS #	Analyte	Reported Value	Units	Qualifier
070904-SED-02817-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	763	pg/g	=
070904-SED-02817-00.3	3268-87-9	OCDD	12900	pg/g	J
070904-SED-02817-00.3	51207-31-9	2,3,7,8-TCDF	36.5	pg/g	=
070904-SED-02817-00.3	57117-41-6	1,2,3,7,8-PECDF	13.4	pg/g	=
070904-SED-02817-00.3	57117-31-4	2,3,4,7,8-PECDF	12.8	pg/g	=
070904-SED-02817-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	17.1	pg/g	=
070904-SED-02817-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	4.1	pg/g	=
070904-SED-02817-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	4.65	pg/g	=
070904-SED-02817-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	2.68	pg/g	=
070904-SED-02817-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	493	pg/g	=
070904-SED-02817-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	26.4	pg/g	=
070904-SED-02817-00.3	39001-02-0	OCDF	2420	pg/g	=
070904-SED-02817-00.3	41903-57-5	TOTAL TCDD	9.41	pg/g	=
070904-SED-02817-00.3	36088-22-9	TOTAL PECDD	5.48	pg/g	=
070904-SED-02817-00.3	34465-46-8	TOTAL HXCDD	73	pg/g	=
070904-SED-02817-00.3	37871-00-4	TOTAL HPCDD	1200	pg/g	=
070904-SED-02817-00.3	55722-27-5	TOTAL TCDF	115	pg/g	=
070904-SED-02817-00.3	30402-15-4	TOTAL PECDF	62.5	pg/g	=
070904-SED-02817-00.3	55684-94-1	TOTAL HXCDF	445	pg/g	=
070904-SED-02817-00.3	38998-75-3	TOTAL HPCDF	2550	pg/g	=
070904-SED-02818-00.3	1746-01-6	2,3,7,8-TCDD	3.23	pg/g	=
070904-SED-02818-00.3	40321-76-4	1,2,3,7,8-PECDD	1.86	pg/g	J
070904-SED-02818-00.3	39227-28-6	1,2,3,4,7,8-HXCDD	0.948	pg/g	U
070904-SED-02818-00.3	57653-85-7	1,2,3,6,7,8-HXCDD	2.5	pg/g	=
070904-SED-02818-00.3	19408-74-3	1,2,3,7,8,9-HXCDD	0.848	pg/g	J
070904-SED-02818-00.3	35822-46-9	1,2,3,4,6,7,8-HPCDD	41.1	pg/g	=
070904-SED-02818-00.3	3268-87-9	OCDD	585	pg/g	=
070904-SED-02818-00.3	51207-31-9	2,3,7,8-TCDF	2730	pg/g	J
070904-SED-02818-00.3	57117-41-6	1,2,3,7,8-PECDF	486	pg/g	=
070904-SED-02818-00.3	57117-31-4	2,3,4,7,8-PECDF	557	pg/g	=
070904-SED-02818-00.3	70648-26-9	1,2,3,4,7,8-HXCDF	154	pg/g	=
070904-SED-02818-00.3	57117-44-9	1,2,3,6,7,8-HXCDF	38.9	pg/g	=
070904-SED-02818-00.3	60851-34-5	2,3,4,6,7,8-HXCDF	28.5	pg/g	=
070904-SED-02818-00.3	72918-21-9	1,2,3,7,8,9-HXCDF	29	pg/g	=
070904-SED-02818-00.3	67562-39-4	1,2,3,4,6,7,8-HPCDF	40.8	pg/g	=
070904-SED-02818-00.3	55673-89-7	1,2,3,4,7,8,9-HPCDF	5.92	pg/g	=
070904-SED-02818-00.3	39001-02-0	OCDF	71.1	pg/g	=
070904-SED-02818-00.3	41903-57-5	TOTAL TCDD	25.9	pg/g	=
070904-SED-02818-00.3	36088-22-9	TOTAL PECDD	11.4	pg/g	=
070904-SED-02818-00.3	34465-46-8	TOTAL HXCDD	20.3	pg/g	=
070904-SED-02818-00.3	37871-00-4	TOTAL HPCDD	92.6	pg/g	=
070904-SED-02818-00.3	55722-27-5	TOTAL TCDF	6530	pg/g	J
070904-SED-02818-00.3	30402-15-4	TOTAL PECDF	1960	pg/g	=
070904-SED-02818-00.3	55684-94-1	TOTAL HXCDF	334	pg/g	=
070904-SED-02818-00.3	38998-75-3	TOTAL HPCDF	102	pg/g	=

Plan

Sampling and Analysis Plan for Sediment Variability Sampling

Prepared for

The Dow Chemical Company

June 2004

CH2MHILL

Contents

Appendixes

Tables **Page**

Figures

Abbreviations and Acronyms

ATV	all-terrain vehicle
bgs	below ground surface
COC	chain of custody
Dow	The Dow Chemical Company
DPT	direct push technology
DQO	data quality objective
Entrix	Entrix, Inc.
ERA	ecological risk assessment
GIS	geographic information system
GPS	global positioning system
HS&E	Health, Safety, and Environment
HSP	health and safety plan
ID	identification
JHA	job hazard analysis
LTI	Limno-Tech Inc.
MDEQ	Michigan Department of Environmental Quality
MI-OSHA	Michigan Occupational Safety and Health Administration
MOCA	Midland Offsite Corrective Actions
MS/MSD	matrix spike/matrix spike duplicate
PCOI	potential contaminants of interest
ppt	part per trillion
QAPP	quality assurance project plan
RI	remedial investigation
SAP	sampling and analysis plan
site	Tittabawassee River study area
SOP	standard operating procedure
STAC	Safety Task Analysis Card
SWP	Safety Work Permit
USEPA	United States Environmental Protection Agency

1 Introduction

1.1 Background

Several previous investigations conducted by the Michigan Department of Environmental Quality (MDEQ) have indicated that dioxins and furans (D&Fs) may be present in sediment and soil in and along the Tittabawassee River. In addition, Limno-Tech, Inc. (LTI) has previously investigated the sediments within the Tittabawassee River as part of the *Preliminary Flow/Solids Monitoring and Sediment Thickness Characterization* (Limno-tech, Inc, 2003). Approximately 22 shallow sediment samples were collected during this event in Fall of 2003. Two locations sampled during this event contained elevated concentrations of D&Fs at 2,870 ppt TEQ and 9,310 ppt TEQ. The sampling activities presented in this sampling and anlytical plan (SAP) are focused on evaluating sediment variability in the vicinity of these samples.

1.2 Purpose and Objectives

The purpose of this SAP is to define the procedures and sampling approach to collect sufficient data to evaluate sediment variability in the areas of elevated D&Fs measured in the Tittabawassee River sediment.

1.3 Scope

The scope of the field effort described in this SAP includes sediment sample collection at randomized locations in transects extending from two existing sample locations where elevated D&Fs concentrations were detected (Figure 1-1). In addition, several samples will be collected in the vicinity of the Saginaw Township Waste Water Treatment Plant (WWTP) outfall to evaluate sediment variability. All sampling and analysis will be performed in accordance with Field SOPs established for the Dow Midland Off-site Corrective Actions (MOCA) program, and the Dow MOCA *Quality Assurance Project Plan* (QAPP) (CH2M HILL 2004c).

1.4 Data Quality Objectives

Data quality objectives (DQOs) are both qualitative and quantitative statements that define the type, quality, and quantity of data necessary to support the decision making process during project activities. The DQO process used for this project follows the USEPA *Guidance for the Data Quality Objectives Process (EPA QA/G-4)* document (USEPA, 2000) and uses the seven-step DQO development process identified in the QAPP. Table 1-1 presents the DQOs associated with the sampling activities.

1.5 Project Team

The team members responsible for the effective execution of this SAP are identified by role in Table 1-2. The program management roles are further defined in the Dow MOCA *Program Management Plan* (CH2M HILL, 2004a).

TABLE 1-1
Data Quality Objectives
Sediment Variability Sampling
Sampling and Analysis Plan

State the Problem	Identify the Decisions	Identify Inputs to the Decisions	Define the Boundaries to the Study	Develop a Decision Rule	Specify Tolerable Limits on Decision Errors	Optimize the Design for Obtaining Data
It is unknown whether elevated dioxin & furan (D&F) concentrations in the Tittabawassee River sediment are the result of isolated detections or are an indication of t of larger contaminated areas.	Can elevated D&F concentrations be verified at the previously sampled locations? If elevated concentrations are confirmed in previously sampled locations, what is the distribution of elevated concentrations?	- Confirmation D&F sample results at the 2 existing locations - D&F results from sediment samples collected from locations at various distances from the original locations of elevated D&F concentrations	The study is limited to surface sediment (0-0.3 ft) of the Tittabawassee river within the vicinity of the elevated D&F concentrations previously detected at these locations.	If elevated D&F concentrations are not detected at surface sediment (0- 0.3 ft) consistent with the previous levels, then the previously sample results reflect sediment heterogeneity and are not an indication of an area of elevated D&F concentrations. If elevated concentrations of D&F are detected in surface sediment samples consistent with previous levels, then evaluate results of surface samples collected from locations extending outward from the location where the presence of elevated D&F concentrations have been confirmed.	The purpose for sampling is to confirm the presence of elevated concentrations and the potential lateral extent of elevated concentrations around the initial sample locations.	A sampling design has been established to collect sufficient data in order to determine if previously detected elevated D&Fs are still present and if present, delineate the lateral extent of elevated concentrations of D&Fs. The approach starts with a central sample near the location of the existing elevated D&Fs and collecting consecutively farther spaced samples along a transect in the direction of river flow and another perpendicular to the direction of flow. Sediment cores will be collected to hand refusal at general distances of 3 ft, 30 ft, 100 ft and 980 ft in each direction. Samples will be collected from the top 10 cm (0.3 ft) at the confirmation location as well as the cores at the 3 ft transect interval and analyzed for D&Fs. The remaining cores/intervals will be frozen and kept for possible future analyses.

TABLE 1-1
Data Quality Objectives
Sediment Variability Sampling
Sampling and Analysis Plan

State the Problem	Identify the Decisions	Identify Inputs to the Decisions	Define the Boundaries to the Study	Develop a Decision Rule	Specify Tolerable Limits on Decision Errors	Optimize the Design for Obtaining Data
If an area(s) of elevated D&F concentrations is identified in the Tittabawassee River surficial sediment, are elevated concentrations of D/Fs also present in deeper sediments?	What is the vertical distribution of elevated D&F concentrations in the laterally delineated areas?	D&F concentrations from sediment cores collected during the evaluation of sediment variability.	The study is limited to subsurface sediment (> 0.3 ft) of the Tittabawassee River within the delineated area of elevated surficial D&F sediment concentrations.	If elevated concentrations of D&F are detected in surface sediment samples consistent with previous levels, then evaluate results of surface samples collected from locations extending outward from the location were the presence of elevated D/F concentrations have been confirmed. A decision(s) rule will be developed during the RI for evaluating the vertical distribution of D&Fs within the Tittabawassee River Sediment.	The purpose for sampling is to confirm potential vertical extent of elevated concentrations.	Sediment cores will be collected as part of the confirmation and lateral extent evaluation. A sediment core segmenting and analytical approach will be identified as part of the RI.
The lateral variability of D&F concentrations surrounding the Saginaw Township WWTP outfall are unknown.	What are the D&F concentrations immediately upstream and downstream of the WWTP?	D&F concentrations from collected sediment cores.	The study is limited to surface sediment (<0.3 ft) in the vicinity of the Saginaw Township WWTP outfall	A set of samples will collected to evaluate the lateral variability of D&F concentrations surrounding the Saginaw Township WWTP.	The purpose for sampling is to determine if D&F are present above and below the Saginaw Township WWTP.	Sediment cores will be collected at upstream and downstream locations adjacent to the Saginaw Township WWTP outfall.

TABLE 1-2
Project Team
Sediment Variability Sampling
Sampling and Analysis Plan

Responsibility	Individual	Affiliation	Contact Information
Senior Environmental Project Leader	Ben Baker	The Dow Chemical Company	47 Building Midland, MI 48667 (989) 636-0787
Project Manager Leader/ Client Point-of-Contact	Gary Dyke	CH2M HILL	1111 Washington Street Midland, MI 48640 (989) 835-1187
Project Manager	Eric Kroger	CH2M HILL	(937) 228-3180, ext. 207
Field Team Leader	Paul Arps	CH2M HILL	1111 Washington Street Midland, MI 48640 Office: (989) 638-8120 Mobile: (989) 205-0522
Field Lead	Cathy Whiting	Limno-Tech, Inc.	501 Avis Drive Ann Arbor, MI 48108 (734) 332-1200
MOCA Health and Safety Manager	Lisa Martin	CH2M HILL	(816) 224-6311
GIS Manager	Randy Vanslambrouck	CH2M HILL	1111 Washington Street Midland, MI 48640 (989) 638-8117
Data Manager	Lane Ebert	CH2M HILL	(215) 563-4244, ext. 448
Project Chemist	Herb Kelly	CH2M HILL	(352) 335-5877, ext. 2572
Contract Sediment Sampling	Tim Dekker	Limno-Tech, Inc.	(734) 332-1200
Contract Laboratory—Dioxin/ Furan Analysis	Martha Maier	Alta Analytical Laboratories	1104 Windfield Way El Dorado Hills, CA 95762 (916) 933-1640

2 Field Activities

The following provides the information necessary for the field team to locate and sample the areas of interest. Refer back to Figure 1-1 for the general location of each area.

Table 2-1 lists the coordinates of the sediment core locations to be collected. Figures 2-1 to 2-2 show the locations of the individual sediment cores to be collected.

2.1 Access to Sampling Areas

Access agreements are not necessary for the sediment sampling described in this document, as long as access to the river is via public boat launches and not by private property.

2.1.1 Utility Clearances

Utility clearances will be necessary prior to the collection of sediment cores. The following service is available for identifying and locating underground utilities in Michigan:

Miss Dig System, Inc.
1-800-482-7171

The Miss Dig System should be contacted at least 3 business days prior to beginning this work. If questions arise in the field regarding utility clearances, the numbers of each utility owner are included in the Dow MOCA Program Health, Safety and Environment (HS&E) Plan (CH2M HILL, 2003).

2.2 Sampling Procedures

2.2.1 Sediment Sampling

The coordinates of the sediment core locations are located in Table 2-1. A GPS unit with submeter precision will be used to locate each core location.

A confirmation sediment core will first be collected from the previously sampled location. Cores will be collected at intervals increasing logarithmically in four directions. The cores will be spaced at intervals of 3 ft, 30 ft, 100 ft, 330 ft, and 980 ft. The locations of the cores include a random component, providing a more robust data set for spatial analysis. Figures 2-1 & 2-2 show the locations of the sediment cores. A GPS unit will be used to locate the sediment core locations.

In addition, 3 sediment core locations will collected in the vicinity of the Saginaw Township Waste Water Treatment Plant (WWTP) outfall. One core each will be collected upstream, downstream, and adjacent to the outfall. The locations of these sediment cores will be determined by the field lead based on their field observations of sediment patterns in the area.

The sediment cores will be collected until hand refusal is met following procedures identified the "Sampling Procedures for Lexan Tube" section located in the in *Core Sediment Sampling Field*

SOP (CH2M HILL, 2004b). Based on site conditions, alternative procedures may be used for the collection of the sediment cores which will be consistent with Dow MOCA SOPs. The optimal method of sample collection will be at the discretion of the field lead after evaluating field conditions.

The top 0.3 ft of the central core, the cores from the 3 ft spacing at each area, and the cores collected in the vicinity of the Saginaw Township WWTP outfall will be homogenized and sent to the laboratory for analysis of D&Fs. The remaining cores at these locations will be frozen and kept for potential future analysis pending the results of the initial analyses.

Coordinates will be collected at the time of sampling from each location using a GPS unit with submeter accuracy and recorded in the field logbook (or sediment core log located in Appendix D).

2.3 Sample Containers, Preservation, and Holding Times

The sample container and preservation requirements are presented in Table 2-2, below. Additional sample container and preservation requirements are given in the QAPP (CH2M HILL, 2004c). All containers should be requested from the contract laboratories for delivery to Midland before the project begins.

The activities associated with the sampling activities must be documented in field logbooks. The procedures and QC procedures for field logbook entries are located in the *Field SOPs* (CH2M HILL, 2004b) and QAPP (CH2M HILL, 2004c).

2.4 Field Quality Control

Field quality control samples will be collected as part of this investigation in accordance with Section 2.5 of the QAPP (CH2M HILL, 2004c). QC samples include the following:

- Field blanks, field duplicates, equipment blanks, and matrix spike/matrix spike duplicates (MS/MSDs) will be collected at a minimum frequency of 1 per 20 samples.
- Field duplicates will be collected at a minimum frequency of 1 per 10 samples.

2.5 Station/Sample Identification

Station identification numbers are listed in Appendix A. Sample numbers must be generated following the guidelines in the *Sample Identification Technical Memorandum*, (CH2M HILL, 2004e).

2.6 Sample Handling and Chain of Custody

The procedures used for proper packaging, shipping, and documentation of samples being transported from the field to the laboratory for analysis are given in the *Sample Handling and Shipping Custody Procedures Field SOP* (CH2M HILL, 2004b).

After samples are labeled and packaged, those intended for dioxin/furan analysis will be shipped to Alta Analytical Laboratory, Inc., at the following address:

Attn: Sample Receiving
Alta Analytical Laboratory, Inc.
1104 Windfield Way
El Dorado Hills, CA 95762
(916) 933-1640

2.7 Equipment Decontamination

- Personal decontamination procedures will be those given in the Dow MOCA Health, Safety and Environment Plan (HSEP; CH2M HILL, 2003).
- All sediment sampling equipment will be decontaminated in accordance with the *Field Decontamination Procedures Field SOP* (CH2M HILL, 2004b).
- Excess sediment, disposable sampling equipment, and decontamination materials and liquids will be disposed of in accordance to the *Handling and Disposal of Investigative-Derived Waste Field SOP* (CH2M HILL. 2004b).

TABLE 2-1
Sediment Station Location GPS Coordinates
Sediment Variability Sampling
Sampling and Analysis Plan

Location	Longitude	Latitude	Up- or downstream of original point	Location	Longitude	Latitude	Up- or downstream of original point
N9, STA 7	-84.08277158	43.45871961	-	N3.25, STA 8	-84.03192543	43.40204224	-
1	-84.08417286	43.45926161	U	16	-84.03492182	43.40316976	U
2	-84.08307251	43.45908444	U	17	-84.03358570	43.40277374	U
3	-84.08283711	43.45878161	U	18	-84.03241975	43.40235708	U
4	-84.08278734	43.45874457	U	19	-84.03202323	43.40207444	U
5	-84.08273027	43.45873689	U	20	-84.03195544	43.40205885	U
6	-84.08278679	43.45871459	U	21	-84.03190018	43.40207165	U
7	-84.08257965	43.45879000	D	22	-84.03193558	43.40203259	U
8	-84.08277168	43.45871876	D	23	-84.03187254	43.40201373	D
9	-84.08283077	43.45868657	D	24	-84.03208184	43.40185291	D
10	-84.08243825	43.45879825	D	25	-84.03141018	43.40175676	D
11	-84.08274318	43.45867610	D	26	-84.03176350	43.40196794	D
12	-84.08271263	43.45862560	D	27	-84.03168271	43.40222611	D
13	-84.08265287	43.45829535	D	28	-84.03180200	43.40217032	D
14	-84.08252144	43.45722739	D	29	-84.02842062	43.40036628	D

TABLE 2-1
Sediment Station Location GPS Coordinates
Sediment Variability Sampling
Sampling and Analysis Plan

Location	Longitude	Latitude	Up- or downstream of original point	Location	Longitude	Latitude	Up- or downstream of original point
15	-84.08296753	43.45579124	D	30	-84.03009002	43.40119743	D
				31	-84.03195649	43.40199291	D
				32	-84.03192522	43.40204159	D

TABLE 2-2
Required Analytical Method, Sample Containers, Preservation, and Holding Times
Sediment Variability Sampling
Sampling and Analysis Plan

Analyses	Preparatory/ Analytical Method	Sample Matrix[a]	Container[b]	Qty	Preservative[c]	Holding Time [d]
Dioxins/Furans	SW-846 8290/EPA Method 1613	W (QC) S	1-L glass 8-oz glass	2 1	Cool 4°C	45 days[e]

Notes:
Sample container and volume requirements will be specified by the analytical laboratory performing the tests.
Three times the required volume should be collected for samples designated as MS/MSD samples.
[a]Sample matrix: S = surface soil, subsurface soil, sediment; W = surface water.
[b]All containers will be sealed with Teflon®-lined screw caps.
[c]All samples will be stored promptly at 4°C in an insulated chest.
[d]Holding times are from the time of sample collection.
[e]30 days to extraction for water, 45 days for analysis.
Source: SW-846, third edition, Update III (June 1997).
ºC = Degrees Centigrade
EPA = U.S. Environmental Protection Agency
L = Liter
oz = Ounce
ASTM = American Society for Testing and Materials
NA = Not applicable

3 Data Management and Validation

All data collected under this field effort will be managed in accordance with the Data Management Plan for Dow MOCA (CH2M HILL, 2004d).

As specified in the QAPP, all analytical data generated to support the Dow MOCA program will be validated. Ten percent of the data packages will be validated to Level IV by a third party subcontractor to CH2M HILL. All other data packages will be validated to Level III by the CH2M HILL project chemist (or designee).

Following validation, data will be entered into a central database. The data will then be accessible for evaluation, interpretation and reporting activities.

4 Health and Safety

4.1 Site Specific HS&E Plan Amendment

A Site-Specific Amendment to the HS&E Plan has been prepared for this project and has been approved by The Health and Safety Manager (HSM). It is included with this SAP as Appendix C. Prior to beginning field work, Field Team members must read and sign the amendment, and follow its requirements.

5 Project Schedule

The soil borings are scheduled for the week of June 21, 2004. Based on that start date, the schedule will be as follows:

Activity	Anticipated Duration	Anticipated Start Date	Anticipated End Date
Work Planning, SAP Development, Contractor Procurement,	2 Weeks	June 7th, 2004	June 18, 2004
Sediment Sampling	5 Days	June 21, 2004	June 25, 2004
Laboratory Analysis	21 Days*	June 28, 2004	July 16, 2004
Data Validation/Data Entry	21 Days	July 19, 2004	August 9, 2004
Sediment Data Available	0 Days	August 9, 2004	NA
Data Interpretation and Reporting	21 Days	August 9, 2004	August 30, 2004
Internal review of Draft Tech Memorandum Summarizing Findings of Lateral Extent	3 Days	August 31 2004	September 2, 2004
Draft Tech Memorandum to Client	0 Days	September 3, 2004	NA

* From date last samples are received.

6 References

Caeiro, S., et al. "Spatial sampling design for sediment quality assessment in estuaries." *Environmental Modeling & Software.* 18. 2003. pp. 853-859.

CH2M HILL. 2003. Dow MOCA Health, Safety and Environment Plan.

CH2M HILL. 2004a. *Dow MOCA Program Management Plan.*

CH2M HILL. 2004b. *Field SOPs.*

CH2M HILL. 2004c. *Quality Assurance Project Plan (QAPP).*

CH2M HILL. 2004d. *Dow MOCA Data Management Plan*.

USEPA. 2000. Guidance for the Data Quality Objectives Process (EPA QA/G-4). EPA guidance document EPA/600/R-96/055. August.

Figures

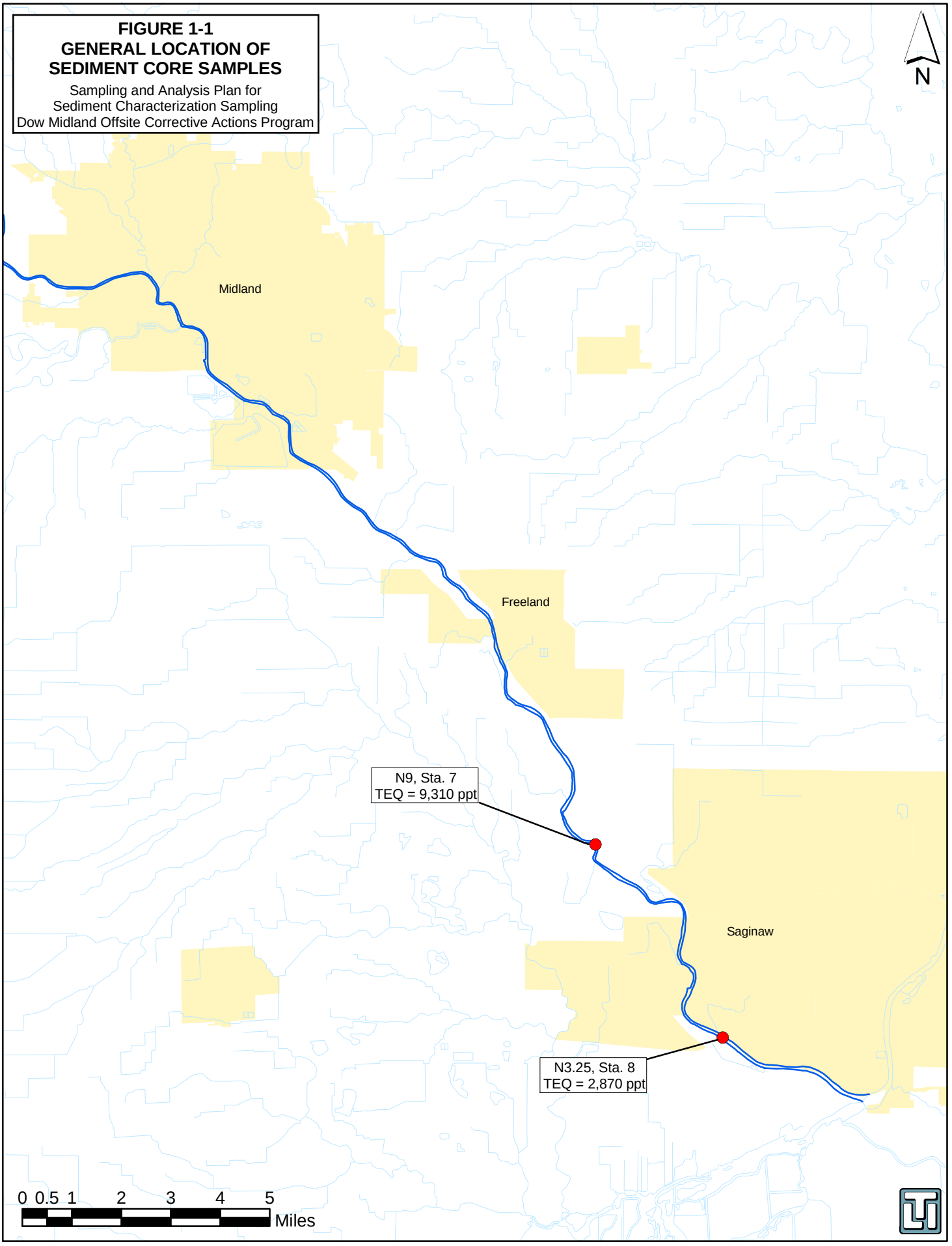
FIGURE 1-1
GENERAL LOCATION OF
SEDIMENT CORE SAMPLES
Sampling and Analysis Plan for
Sediment Characterization Sampling
Dow Midland Offsite Corrective Actions Program
N
Midland
Freeland
Saginaw
N9, Sta. 7
TEQ = 9,310 ppt
N3.25, Sta. 8
TEQ = 2,870 ppt
0 0.5 1 2 3 4 5
Miles

Figure 2-1: Locations of Sediment Cores around N9 Station 7 in the Tittabawassee River

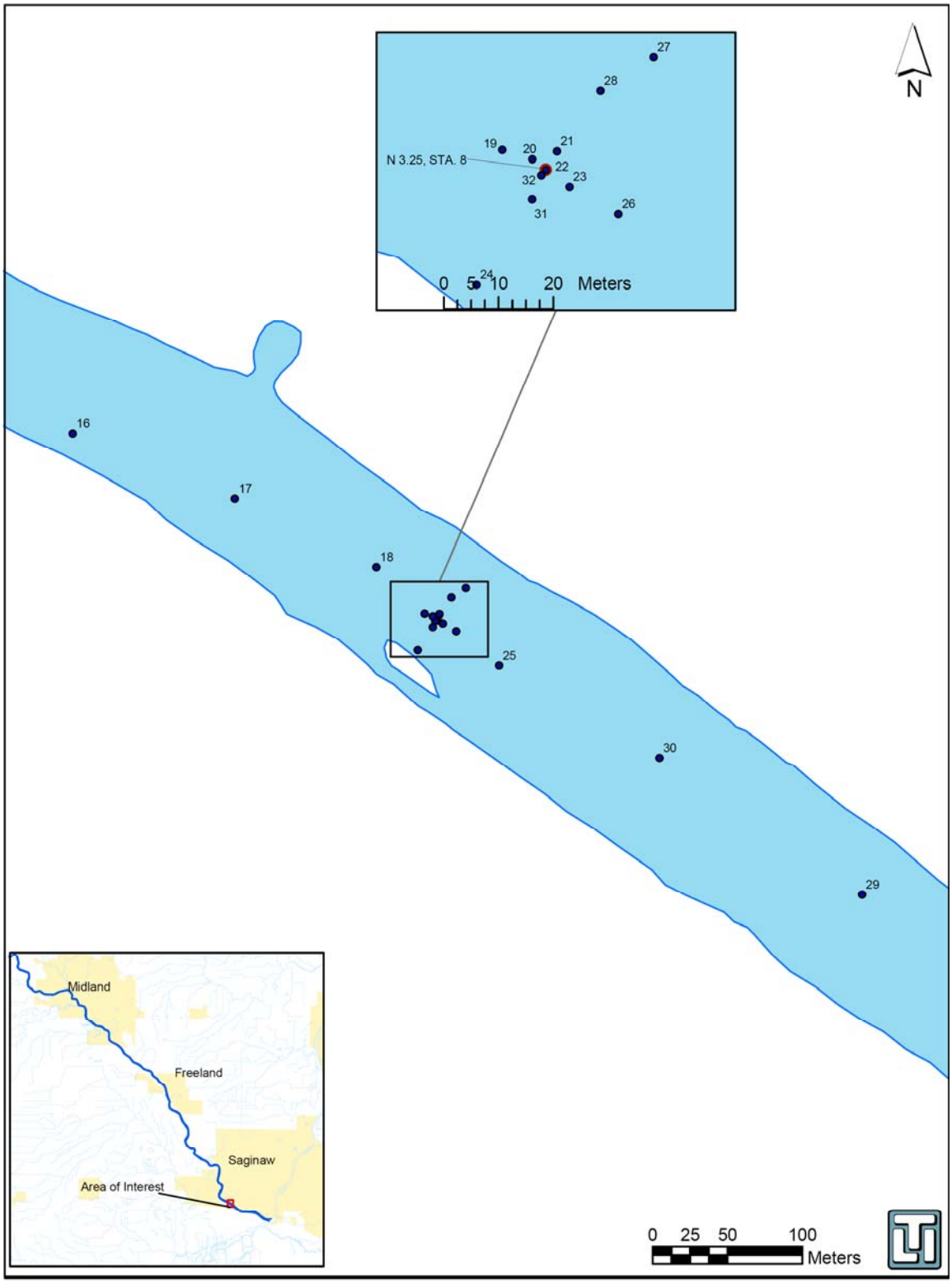

Figure 2-2: Locations of Sediment Cores around N3.25 Station 8 in the Tittabawassee River

Appendix A
Station IDs

Appendix A
Identification of Sediment Core Locations
Sediment Variability Sampling Sampling and Analysis Plan
Dow Midland Off-site Corrective Actions Program

Core Location	Longitude	Latitude	Station Location
N9, STA 7	-84.08277158	43.45871961	THT-
1	-84.08417286	43.45926161	THT-
2	-84.08307251	43.45908444	THT-
3	-84.08283711	43.45878161	THT-
4	-84.08278734	43.45874457	THT-
5	-84.08273027	43.45873689	THT-
6	-84.08278679	43.45871459	THT-
7	-84.08257965	43.45879	THT-
8	-84.08277168	43.45871876	THT-
9	-84.08283077	43.45868657	THT-
10	-84.08243825	43.45879825	THT-
11	-84.08274318	43.4586761	THT-
12	-84.08271263	43.4586256	THT-
13	-84.08265287	43.45829535	THT-
14	-84.08252144	43.45722739	THT-
15	-84.08296753	43.45579124	THT-
N3.25, STA 8	-84.03192543	43.40204224	SHL-
16	-84.03492182	43.40316976	SHL-
17	-84.0335857	43.40277374	SHL-
18	-84.03241975	43.40235708	SHL-
19	-84.03202323	43.40207444	SHL-
20	-84.03195544	43.40205885	SHL-
21	-84.03190018	43.40207165	SHL-
22	-84.03193558	43.40203259	SHL-
23	-84.03187254	43.40201373	SHL-
24	-84.03208184	43.40185291	SHL-
25	-84.03141018	43.40175676	SHL-
26	-84.0317635	43.40196794	SHL-
27	-84.03168271	43.40222611	SHL-
28	-84.031802	43.40217032	SHL-
29	-84.02842062	43.40036628	SHL-
30	-84.03009002	43.40119743	SHL-
31	-84.03195649	43.40199291	SHL-
32	-84.03192522	43.40204159	SHL-

Appendix B
Target Analyte Lists

TABLE B-1
Target Analyte List A for Soils and Sediments—All Selected Analytes
Sedeiment Variability Study
Sampling and Analysis Plan

Parameter/Method	Analyte	Soil/Sediment	
		RL	Unit
Dioxins and Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1.0	ng/Kg
SW8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	5.0	ng/Kg
	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	5.0	ng/Kg
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	5.0	ng/Kg
	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	5.0	ng/Kg
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	5.0	ng/Kg
	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	10	ng/Kg
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1.0	ng/Kg
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	5.0	ng/Kg
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	5.0	ng/Kg
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	5.0	ng/Kg
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	5.0	ng/Kg
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	5.0	ng/Kg
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	5.0	ng/Kg
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	5.0	ng/Kg
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	5.0	ng/Kg
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	10	ng/Kg

TABLE B-2
Target Analyte List for Aqueous Matrix—All Selected Analytes
Sedeiment Variability Study
Sampling and Analysis Plan

Parameter/Method	Analyte	Water	
		RL	Unit
Dioxins and Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.01	ng/L
SW8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.05	ng/L
	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.05	ng/L
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.05	ng/L
	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.05	ng/L
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.05	ng/L
	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.1	ng/L
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.01	ng/L
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.05	ng/L
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.05	ng/L
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.05	ng/L
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.05	ng/L
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.05	ng/L
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.05	ng/L
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.05	ng/L
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.05	ng/L
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.1	ng/L

Appendix C

Site Specific HS&E Plan Amendment

Dow Program

CH2M HILL HEALTH, SAFETY AND ENVIRONMENT PLAN

Site-Specific Amendment No. 3

This amendment must accompany the Health, Safety and Environment Plan (HS&E Plan) for the **Dow Chemical Company Midland** project approved on **April 1, 2004**. The purpose of the HS&E Plan amendment is to include supplemental information as it becomes available. Supplemental information will be used to specify dates of site work for individual tasks, verify CH2M HILL onsite personnel and responsibilities, list site-specific subcontractors and contractors, and reevaluate hazards associated with the planned activities.

Where the amendment contains information different from the HS&E Plan, the amendment will take precedence for the specified task. The amendment includes new information or revises existing HS&E Plan information. Sections of the HS&E Plan that are not addressed in the amendments do not have changes; therefore, the HS&E Plan will be followed. All employees performing tasks covered by this amendment must read both the HS&E Plan and this amendment and agree to abide by their provisions (see Attachment 1).

Project Information and Description

PROJECT NO:	318032.01.VE (Original H&E Plan 188182 and 188194)
CLIENT:	The Dow Chemical Company
PROJECT/SITE NAME:	Midland
SITE ADDRESS:	This HS&E Plan Amendment is intended to cover activities associated with Offsite Corrective Action fieldwork associated with Dow's Midland Plant, as described under Condition XI.B of Dow's June, 2003 Operating License. Specific areas in which work will occur include: (1) Sediments and floodplain soils of the Tittabawassee River from approximately 1 mile upstream of Dow Midland Plant to approximately 11 miles downstream to the confluence of the Tittabawassee and Saginaw Rivers and also upstream of the Plant along the Chippawa River. Activities covered will consist of investigation, Interim Response Activities, and corrective actions.
CH2M HILL PROJECT MANAGER:	Gary Dyke
CH2M HILL OFFICE:	Midland
DATE HS&E PLAN PREPARED:	12/29/2003
DATE AMENDMENT PREPARED:	June 9, 2004
DATE(S) OF SITE WORK:	June 28 – July 2, 2004 (Boating and sediment sampling)

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Description of Tasks for this Site-Specific Amendment:

Task 1: SEDIMENT SAMPLING. Collect sediment samples from 40 locations along the Tittabawassee River, by boat (work will be contracted out). Conditions may exist requiring the samplers to leave the boat during the sampling activities to wade through portions of the river.

1.1.1 Hazwoper-Regulated Tasks

- Sediment Sample Collection by boat
- Sediment Sample Collection by wading

1.1.2 Non-Hazwoper-Regulated Tasks

TASKS	CONTROLS
• GPS Surveying	• Brief on hazards, limits of access, and emergency procedures • Post contaminant areas as appropriate (refer to Section 8.2 for details) • Sample and monitor as appropriate (refer to Section 5.0)

2 Control Measures

This section provides safe work practices and control measures used to reduce or eliminate potential hazards and risks.

Each individual must complete a safety task analysis card or STAC (see Attachment 4 of the original HS&E Plan). STACs must be completed daily and updated as site conditions and/or activities change, or potential changes arise.

A Project-Activity Self-Assessment Checklist for "Boating" is contained in Attachment 4 of this amendment. The checklist will be completed at the beginning of boating activities, and once weekly. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Formal observations are not required for the tasks under this amendment since there are fewer than three employees working less than five days onsite for each task; however observations may be done at any time. Interventions are required. Interventions will occur when an unsafe behavior or work condition is observed. Each person conducting 40 or more hours per month of field work must document interventions on the STAC or intervention card at a rate of one per 40 hours worked.

Additionally, as indicated in Section 2.1.1, a Safe Work Permit for "Boating" will be completed on a daily basis for this activity. A Safe Work Permit for "Pressure Washing" will be completed as necessary for decontaminating equipment.

Safe Work Permits are incorporated as Attachment 2 of this HS&E Plan Amendment. Completed Safe Work Permits must be submitted to Jeannie Armstrong/SEA for internal and Dow review.

2.1 Project-Specific Control Measures

2.1.1 Boating

The following control measures are excerpted from Section 2.1.2 of the original HS&E Plan, and apply to subcontractor personnel performing boating and sediment sampling. Additionally, a Safe Work Permit for Boating will be completed on a daily basis, and a Safe Work Permit for Pressure Washing will be completed as necessary for decontaminating equipment (both included in Attachment 2 of this HS&E Plan Amendment). A Job Hazard Analysis (JHA) for sediment sampling activities has been prepared by the subcontractor and is incorporated as Attachment 3 of this HS&E Plan Amendment.

- All operations involving boating will be directed by an experienced boater.
- The Safe Boating Checklist found in Attachment 4 of this amendment will be completed at the beginning of boating activities, and once weekly.
- Michigan boating laws must be adhered to when operating a boat during visual surveying activities. Refer to "The Handbook of Michigan Boating Laws and Responsibilities," which is available online at http://boat-ed.com/mi/handbook/pdf/miguide.pdf.
- All staff must wear U.S. Coast Guard (USCG) approved personnel flotation devices (PFDs) when aboard the boat.
- One Type IV USCG-approved PFD (throwable cushions or ring buoys) must be onboard and readily accessible on vessels 16 feet or longer.
- The boating team will include at least one person qualified in First Aid and CPR.
- All personnel shall wear bright colors (for example: hunter orange, yellow, etc.) to enhance their visibility to one another.
- The SC has final authority on operations with regards to weather and water conditions.
- Safe means of boarding or leaving the boat or platform must be provided to prevent slipping and falling.
- Employees should be instructed on safe use of the boat.
- Never exceed the load limit of the boat.
- The boat must be equipped with a Type B fire extinguisher if the boat has permanently installed fuel tanks, portable fuel tanks, or compartments in which flammable or combustible materials are stored. The extinguisher must be mounted in an accessible area, and labeled "Marine Type USCG Approved," followed by the size and type symbols and the approval number. Refer to "The Handbook of Michigan Boating Laws and Responsibilities" for additional fire extinguisher requirements.
- The boat must be equipped with the appropriate navigation lights for the type of boat being used for nighttime and poor visibility conditions (refer to "The Handbook of Michigan Boating Laws and Responsibilities").
- The boat must be equipped with the appropriate sound producing devices for the type of boat being used (refer to "The Handbook of Michigan Boating Laws and Responsibilities") .
- The boat must be equipped with an anchor and alternative means of locomotion (extra motor, floatable oars).
- Weather and water conditions must be monitored to determine if it is safe to be out on a water body.

- Work requiring the use of a boat will not take place at night or during inclement weather.
- Shut off engine before refueling. Do not smoke while refueling.
- Remain seated in the boat or canoe whenever possible.
- Never stand on the gunwales of a boat except when needed for embarking or disembarking.

2.1.2 Wading

The following physical hazards may exist on this project including hazards associated with wading in 3 to 4 feet of water, and working from a boat or canoe.

- Although the river and lake areas we will be working in are wadeable in places, there may be deep spots. Care will be taken when wading not to proceed beyond waist deep.
- Wading will not be performed without a buddy nearby.
- U.S. Coast Guard-approved PFD, or life jacket, shall be worn by both the person wading and the buddy.
- Inspect PFDs prior to use. Do not use defective PFDs.
- A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope must be provided for emergency rescue.
- Waders will not be worn when personnel are in the boat.
- The sediments may be soft and there is a possibility of sinking. When wading, team members are cautioned to be careful of footing.

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HSE-01, *Medical Surveillance,* and HSE-02, *Health and Safety Training)*

Employee Name	Office	Responsibility	SC/FA-CPR
Paul Arps	MOCA Site	Field Team lead	Level C SSC; FA/CPR
Gary Dyke	MOCA Site	Project Manager Leader	
Eric Kroger	DAY	Project Manager	

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Contact Name: Dow Chemical Company

Facility Contact Name: Ben Baker

Phone: 989/636-0787

The contact at security to notify for work along the river on Dow property is Jack Johnson (989) 638-1429.

3.2.2 CH2M HILL

Project Manager Leader: Gary Dyke/LSG/MOCA Site

Project Manager: Eric Kroger/DAY

Health and Safety Manager: Lisa Martin/DEN

Environmental Compliance Coordinator: Jessica Raphael/DET

Field Team Leader: Paul Arps/LSG/MOCA Site

Safety Coordinator: Paul Arps/LSG/MOCA Site

The SC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HSE-55, *Subcontractor, Contractor, and Owner*)

Subcontractor: LimnoTech, Inc.
Subcontractor Contact Name: Tim Dekker
Telephone: (734) 332-1200
Subcontractor Tasks(s): Perform surface sediment sample collection.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HSE-07, *Personal Protective Equipment*; HSE-08, *Respiratory Protection*)

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
GPS Surveying	D	Work clothes; steel-toe, leather work boots; work gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required
Sediment sample collection by boat	Modified D	**Coveralls:** Not required unless work clothes can't be kept reasonably clean, at which time cotton coveralls will be worn **Boots:** Steel-toe, leather work boots; for muddy/wet conditions - steel-toe, chemical-resistant boots **Gloves:** Nitrile gloves. **Personal Flotation Devices (PFDs) must be worn on the boat.**	Hardhat [c] Safety glasses Ear protection [d]	None required.
Sediment sample collection by wading	Modified D	**Coveralls:** Not required unless work clothes can't be kept reasonably clean, at which time cotton coveralls will be worn **Waders:** To be worn only while wading – not while in boat **Gloves:** Nitrile gloves. **Personal Flotation Devices (PFDs) must be worn on the boat.**	Hardhat [c] Safety glasses Ear protection [d]	None required.

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[f]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

[b] No facial hair that would interfere with respirator fit is permitted.

[c] Hardhat and splash-shield areas are to be determined by the SC.

[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)-, then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.

[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements[have been approved by the HSM, and an SC qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HSE-06, *Air Monitoring)*

None Required

11 Approval

This site-specific Health, Safety and Environment Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

11.1 Original Plan

Written By: **Catherine Geiger/CHI** **Date:** **11/24/2003**

Approved By: Lisa D. Martin **Date:** **04/01/2004**

_Lisa Martin _____
RHSPM

_Jessica Raphael_____
ECC

11.2 Revisions

Revisions Made By: **Wayne Ekren/ LSG** **Date:** **June 9, 2004**

Revisions to Plan: **Amended plan to cover June 2004 boating and sediment sampling activities, and updated the associated hazards and controls, project personnel, subcontractors, PPE, and air monitoring requirements for these tasks.**

Revisions Approved By: Lisa D. Martin **Date:** **June 25, 2004**

_Lisa Martin _____
RHSPM

_Jessica Raphael_____
ECC

12 Attachments

Attachment 1: **Employee Signoff Form – Health & Safety Plan**

Attachment 2: **Safe Work Permits - Boating and Pressure Washing**

Attachment 3: **Limno-Tech, Inc. Job Hazard Analysis for Sediment Sampling**

Attachment 4: **HS&E Self-Assessment Checklist - Boating**

Attachment 1

Employee Signoff Form – Health & Safety Plan

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

Amendment No. 3

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: Dow, Midland, Michigan **Project Number:** 318032.01.VE

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

Attachment 2

Safe Work Permits – Boating and Pressure Washing

Attachment 3

Limno-Tech, Inc. Job Hazard Analysis for Sediment Sampling

Attachment 4

HS&E Self-Assessment Checklist – Boating

Health and Safety Self Assessment Checklist - BOATING

This self assessment is only to be used at locations where CH2M HILL controls the work. It is not to be used at locations where others control the work.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

If an assessment item is complete/correct the "Yes" box should be checked. If an item is incomplete or deficient the "No" box should be checked. Items that are considered to be imminently dangerous must be corrected immediately or all exposed personnel must be removed from the hazard. All deficiencies shall be brought to the attention of the appropriate party that is responsible for correcting the deficiency. If an item is not applicable, the "N/A" box should be checked. If an item is applicable but was not observed during the assessment, the "N/O" box should be checked.

	Yes	No	NA	N/O
GENERAL				
1. Weather forecast checked.	☐	☐	☐	☐
2. At Least one Team Member is trained in First Aid/CPR.	☐	☐	☐	☐
3. Lights, horn, battery, fuel, steering, bilge pump, anchor & propeller checked.	☐	☐	☐	☐
4. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
5. Personal Floatation Devices (PFD's) inspected daily.	☐	☐	☐	☐
6. Fire extinguisher available, charged and accessible.	☐	☐	☐	☐
7. First aid kit available	☐	☐	☐	☐
8. Project Instructions and H&S Plan available	☐	☐	☐	☐
9. Potable water available	☐	☐	☐	☐
10. Sunscreen & Bug Spray available	☐	☐	☐	☐
11. Distress communications available (flare gun, air horn, Cell phone, CB)	☐	☐	☐	☐
12. An oar is available on board the boat in the event of mechanical failure	☐	☐	☐	☐
BOAT TRANSPORT				
13. Boat motor secured prior to boat transport	☐	☐	☐	☐
14. Turn signals and brake lights verified as operable.	☐	☐	☐	☐
15. Safety chains available on trailer and secured in a criss-cross fashion	☐	☐	☐	☐
16. Trailer winch engaged	☐	☐	☐	☐
17. Ball hitch seated and latch pin installed	☐	☐	☐	☐
18 Tools and equipment secured prior to boat movement	☐	☐	☐	☐
19 Personnel not allowed ride on boat as it is being towed	☐	☐	☐	☐
20. Safe distance is maintained with traveling around power lines	☐	☐	☐	☐
21. Backup alarm or spotter used when backing boat	☐	☐	☐	☐
22. Boat is unhitched on a level and stabile surface	☐	☐	☐	☐
BOAT OPERATION				
23. Boat holds appropriate size load	☐	☐	☐	☐
24. Personnel cleared during boat start-up	☐	☐	☐	☐
25. Kill switch clearly identified and operational	☐	☐	☐	☐
26. Personnel wearing appropriate PPE	☐	☐	☐	☐
27. All personnel wearing PFD's	☐	☐	☐	☐
28. Boat will not be used for recreational purposes	☐	☐	☐	☐

Appendix D
Sediment Core Log

Dow: MOCA
Sediment Variability Study
Sediment Core Log

Field Personnel:		**Date:**		**Time:**	
Weather Conditions:		**Area ID:**		**Station Number:**	
Northing		US State Plane 1983, Michigan South 2113, International Feet			
Easting		US State Plane 1983, Michigan South 2113, International Feet			

Water Depth		**Units**		**Sediment Penetrated**		**Units**	
Sediment Thickness		**Units**		**Sediment Recovered**		**Units**	

Depth Interval (decimal feet)	**Sediment Description**	**Sample ID**

Other Comments:

Core Logger Signature: